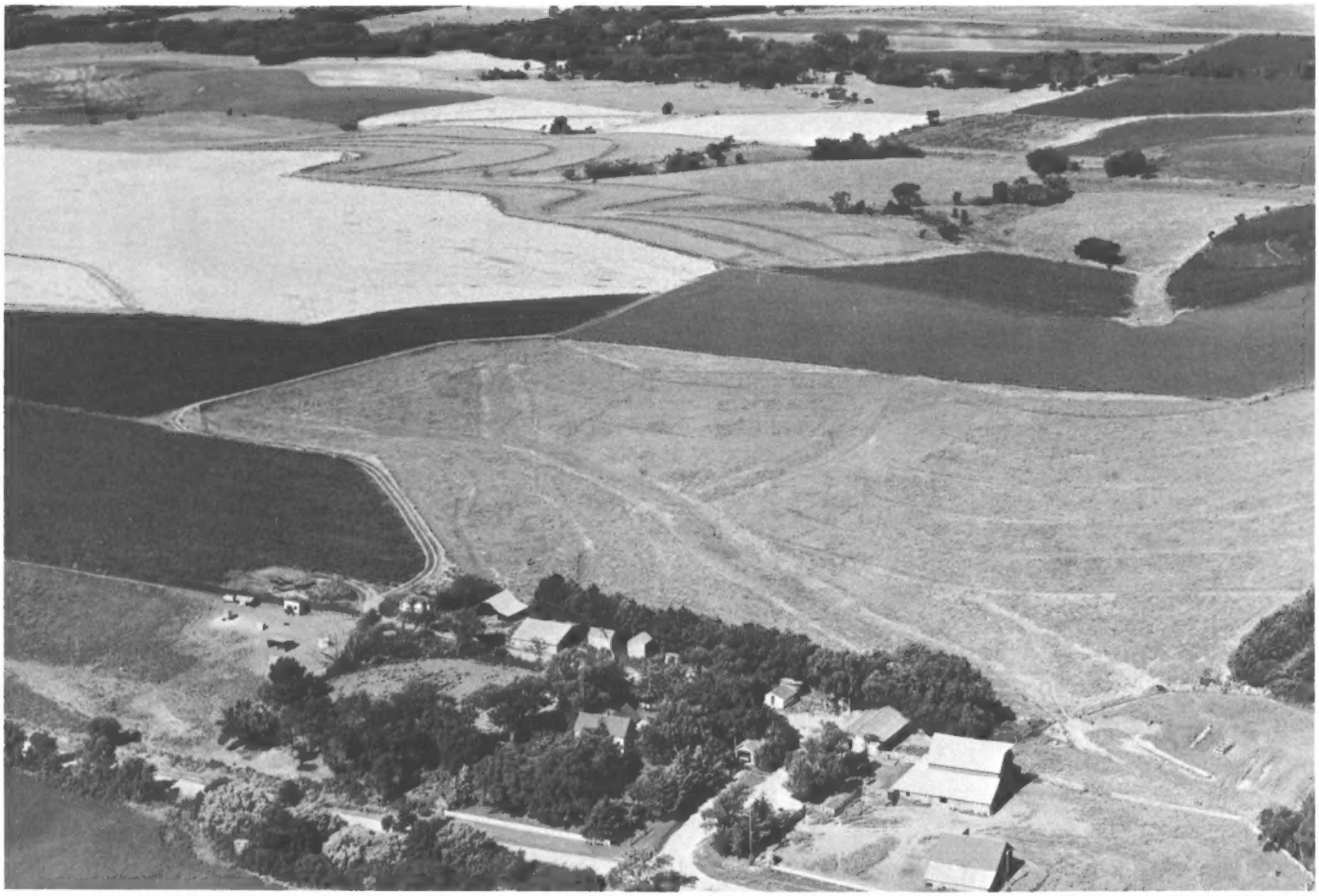
SOIL SURVEY OF

Jefferson County, Nebraska



United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska
Conservation and Survey Division

Major fieldwork for this soil survey was done in the period 1963–1968. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Little Blue and the Lower Big Blue Natural Resource Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Jefferson County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page of the windbreak suitability group and range site to which the soil has been assigned.

Individual colored maps showing the relative suitability or degree of limitation of soils for specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units, the range sites, and the windbreak groups.

Foresters and others can refer to the section "Management of the Soils for Woodland and Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Management of the Soils for Wildlife."

Ranchers and others can find, under "Management of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the soil descriptions and in the section "Engineering Evaluation of the Soils."

Engineers and builders can find, under "Engineering Evaluation of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Jefferson County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Soil-conserving practices on sloping soils of the Geary-Hastings association. (Photo courtesy of Richard Hufnagle.)

Contents

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SOIL SURVEY OF JEFFERSON COUNTY, NEBRASKA

BY ROBERT S. POLLOCK AND LYLE L. DAVIS, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH UNIVERSITY OF NEBRASKA, CONSERVATION AND SURVEY DIVISION

JEFFERSON COUNTY is in the southeastern part of Nebraska (fig. 1). It has a total area of 576 square miles, or 369,280 acres. Fairbury, the county seat and largest town, is near the center of the county. Growing cash-grain crops and raising livestock are the principal farm enterprises. About three-fourths of the acreage is cultivated. The rest is chiefly in native grass. A small part is wooded. Deep-well irrigation is important in farming in the northern half of the county.

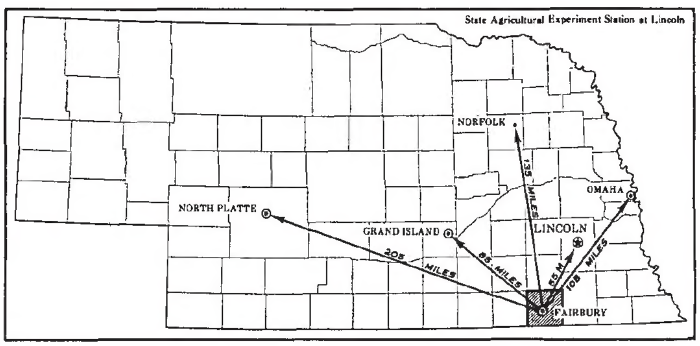

Figure 1.—Location of Jefferson County in Nebraska.

The principal dryland crops are sorghum, wheat, corn, and alfalfa. Corn and grain sorghum are the principal irrigated crops. The livestock in the county are mainly beef cattle, dairy cattle, and swine.

An older soil survey of Jefferson County was published in 1925 (*5*).[1] The present survey was made to provide additional, up-dated information on the technical advances in farming methods, engineering, and soil classification.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Jefferson County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hastings and Crete, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Crete silt loam, 1 to 3 percent slopes, is one of several phases within the Crete series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

[1] Italic numbers in parentheses refer to Literature Cited, page 71.

Some mapping units are made up of soils of different series, or of different phases within one series. Only one such kind of mapping unit is shown on the soil map of Jefferson County: *an undifferentiated group.*

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Geary and Jansen soils, 5 to 11 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Silty alluvial land is a land type in Jefferson County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing medium for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to slow permeability or a high water table. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to a high shrink-swell potential. Thus, they use observations and knowledge of soil properties, together with available research data, to predict the limitations or suitability of a soil for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Jefferson County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in Jefferson County are described on the following pages.

1. Hobbs-Hord-Cass Association

Nearly level and gently sloping, deep silty and loamy soils on alluvial benches and bottom land

This association is in narrow valleys along the Little Blue River and most of the major creeks in the county (fig. 2). It is mainly nearly level to gently sloping.

The total area of this association is about 43,500 acres, or nearly 12 percent of the county. It is about 86 percent Hobbs soils, 7 percent Hord soils, 5 percent Cass soils, and 2 percent alluvial land.

Soils of the Hobbs series are deep, well drained, and nearly level to gently sloping. They formed in silty alluvium on narrow bottom land and on foot slopes in the valleys of perennial streams. The surface layer is thick, dark-gray silt loam that becomes gray or grayish brown with increasing depth. The underlying material, to a depth of 5 feet, is grayish-brown, noncalcareous alluvium. Some areas are flooded for short periods.

Soils of the Hord series are deep, nearly level to gently sloping, and well drained. They formed in silty alluvium on benches and sides of drainageways adjacent to perennial streams. They have a thick surface layer and subsoil of grayish-brown or gray silt loam. The underlying material is pale-brown or grayish-brown silt loam.

Cass soils are deep, nearly level, and well drained. They formed in loamy and sandy alluvium on bottom land of the Little Blue River and Big Sandy Creek. The surface layer is dark-gray loam. The subsoil is stratified, light brownish-gray fine sandy loam that contains a few lenses of silt or coarser sand. The underlying material is light-gray sandy alluvium mottled with rusty brown. The water table is generally at a depth of 5 to 7 feet.

Silty alluvial land, Sandy alluvial land, and Wet alluvial land are in the lowest parts of the landscape, adjacent to the major streams and their tributaries. They are subject to frequent flooding and have a high water table.

Nearly all of this association is cultivated. Some areas adjacent to streams are in grass or timber. Corn, grain sorghum, alfalfa, and wheat are the most commonly grown crops. Some areas are irrigated from wells, and others from flowing streams by using surface pumps. Corn and grain sorghum are the principal irrigated crops. Hobbs and Cass soils are subject to flooding for short periods. Water erosion is no particular concern.

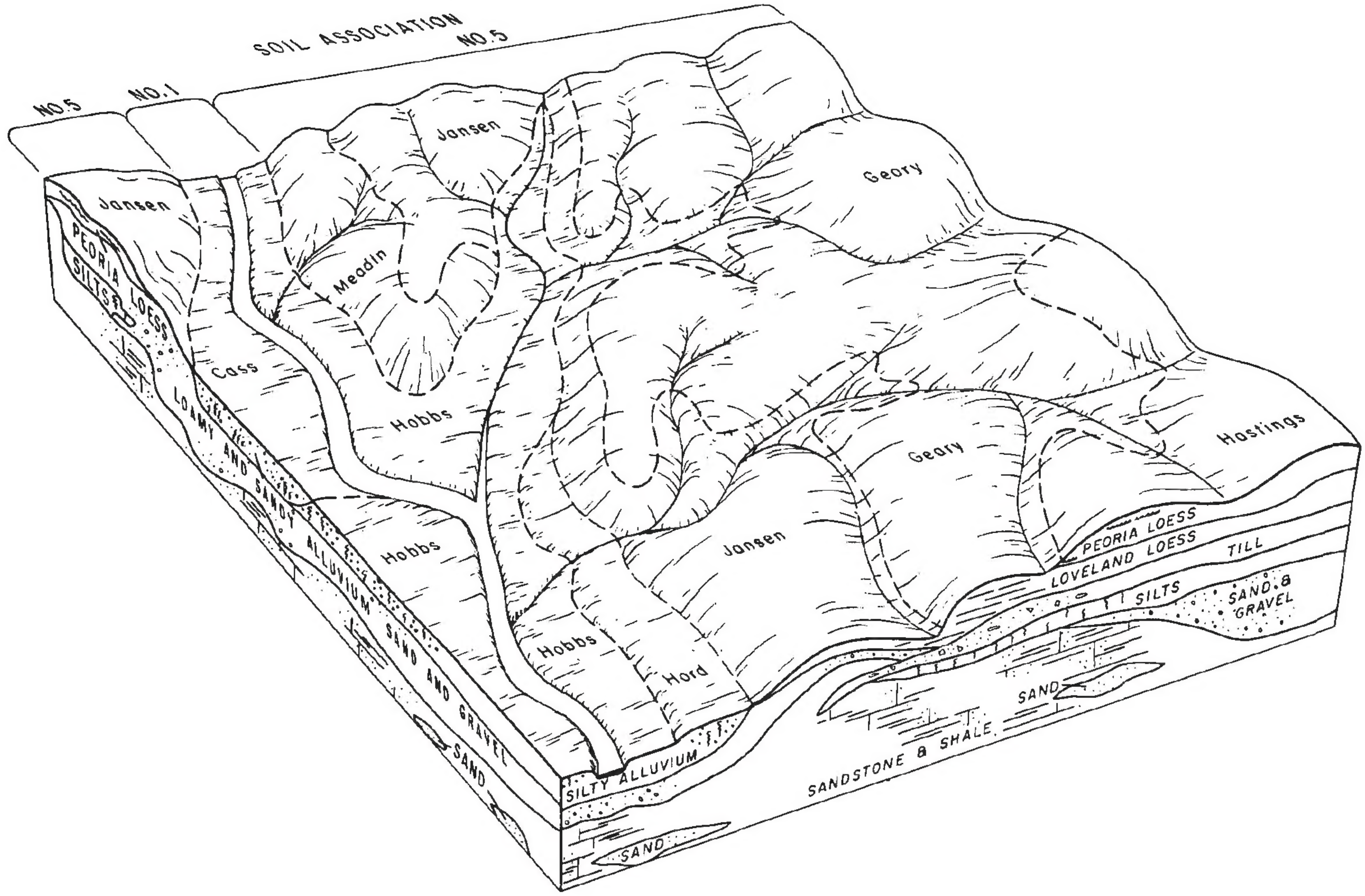

Figure 2.—**Typical pattern of soils and parent material in the Hobbs-Hord-Cass and Geary-Jansen associations.**

Maintaining good tilth and high fertility is the primary concern in irrigated areas.

Farms range from 120 to 480 acres in size and are generally of the cash-grain or a combination grain-livestock type. Nearly all extend into the uplands. Some section lines have gravel roads, and a few have improved dirt roads. Some have no roads, and others have only trails. Good gravel or hard surface roads parallel the Little Blue River. Bridges across the river are 2 to 4 miles apart. Farm produce is marketed in nearby towns within the county or in adjacent counties.

2. Crete-Mayberry Association

Nearly level to strongly sloping, deep soils that have a silty surface layer and a clayey subsoil; on loess and glaciated uplands

This association is on loess uplands where the soils are mainly nearly level to moderately sloping. A few strongly sloping soils are on sides of intermittent drainageways that traverse the areas (figs. 3 and 4).

The total area of this soil association is about 198,000 acres, or nearly 54 percent of the county. It is about 80 percent Crete soils, 11 percent Mayberry soils, and 9 percent soils of minor extent.

Soils of the Crete series are deep, nearly level to moderately sloping, moderately well drained claypan soils that formed in loess. The surface layer is gray silt loam. The upper part of the subsoil is dark-gray or grayish-brown silty clay, and the lower part is light olive-gray silty clay loam. The underlying loess is calcareous, mainly light brownish gray, and of silt loam texture. In the west-central part of the county, it is pale-brown heavy silt loam.

Soils of the Mayberry series are deep, moderately sloping to strongly sloping, well-drained soils that formed in reworked till. The surface layer is dark-gray silty clay loam, and the subsoil is reddish-brown silty clay that grades to strong brown with increasing depth. The underlying material is noncalcareous, reworked till that is reddish yellow and of silty clay loam texture.

Minor in this association are the Hastings, Hobbs, Hord, Geary, and Butler soils. Hastings soils generally are moderately sloping and are downslope from the Crete soils. Hobbs soils are on bottom lands of drainageways. Butler soils are nearly level and somewhat poorly drained. They occur as slight depressions in the uplands. Hord soils are nearly level to gently sloping and are on narrow benches of uplands drainageways. Geary soils are moderately sloping to steep and are on hillsides and the sides of upland drainageways.

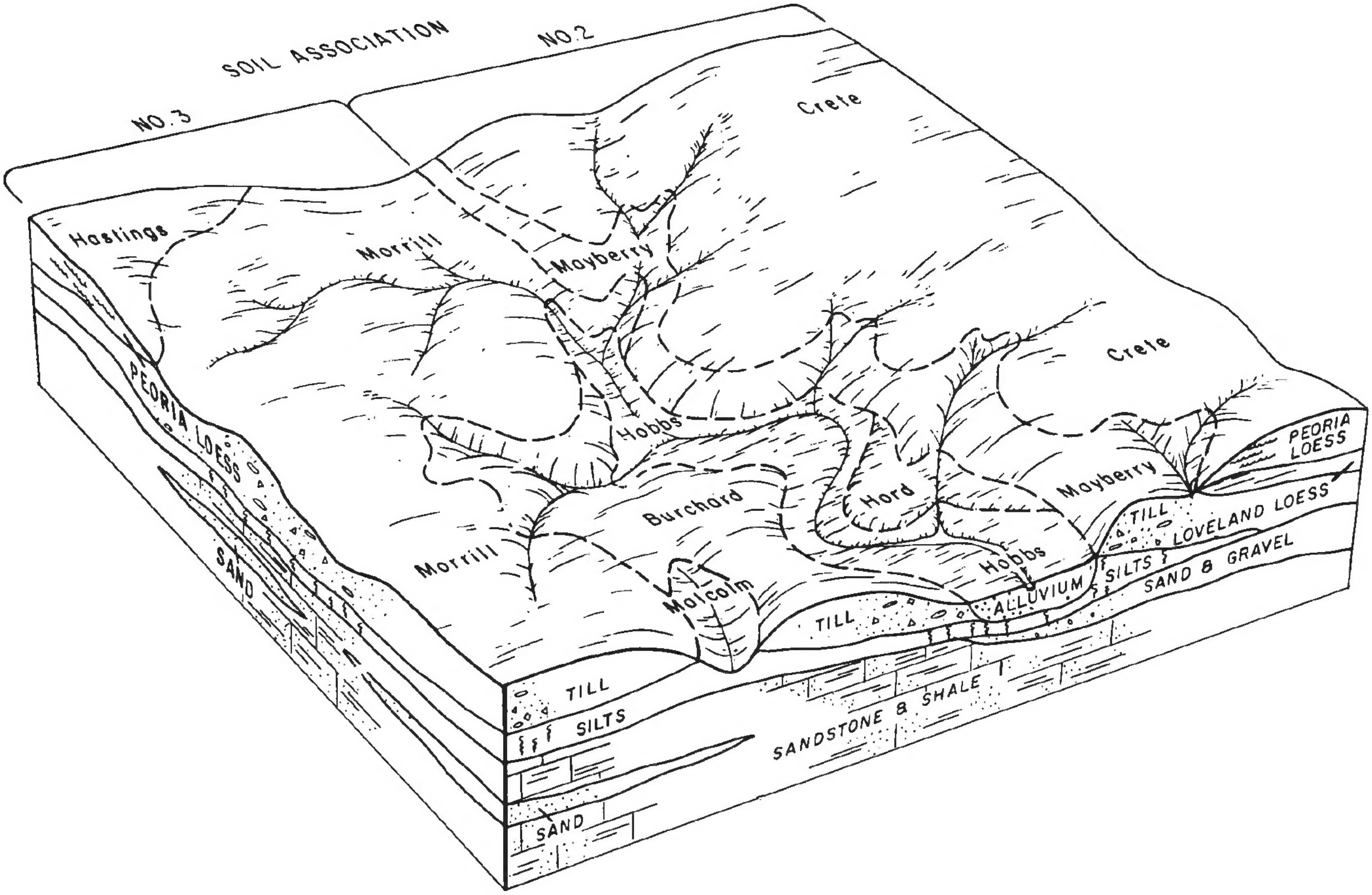

Figure 3.—**Typical pattern of soils and parent material in the Morrill-Burchard and Crete-Mayberry associations.**

Most of this association is cultivated. Only a small part is still in native grass. Corn, grain sorghum, wheat, and alfalfa are the main crops. Corn and grain sorghum are the principal irrigated crops. The nearly level and gently sloping Crete soils are extensively irrigated from deep wells, where water is available. Water erosion is a hazard on the sloping soils. The major soils in this association have a clayey subsoil that limits root penetration and the movement of water. All are somewhat droughty during periods of low rainfall. Maintaining fertility and managing water are the main concerns in irrigated areas.

Farms range from 160 to 480 acres in size, and nearly all are of the cash-grain or a combination grain-livestock type. Cattle and hogs are raised and fed for market. Gravel roads are on most section lines. Adequate markets for farm produce are available in nearby towns within the county and in adjacent counties.

3. Morrill-Burchard Association

Moderately sloping to steep, deep loamy soils on glaciated uplands

This association consists of moderately sloping to steep soils on glacial till uplands. It is on ridgetops and on sides of intermittent drainageways that dissect the landscape along Rock Creek and Whisky Run (see fig. 3).

The total area of this association is about 27,000 acres, or nearly 7 percent of the county. It is about 72 percent Morrill soils, 21 percent Burchard soils, and 7 percent soils of minor extent.

Soils of the Morrill series are deep, moderately sloping to strongly sloping, well-drained soils that formed in reworked till. The surface layer is dark-gray clay loam. The subsoil is dark-brown or brown clay loam in the upper and middle parts and light yellowish-brown clay loam in the lower part. The underlying material is very pale brown, reworked till material of clay loam or sandy clay loam texture. Glacial stones make up less than 1 percent in the upper 5 feet in some places.

Soils of the Burchard series are deep. moderately to strongly sloping. well-drained loamy soils that formed in limy glacial material. The surface layer is dark grayish-brown clay loam. The subsoil is pale-brown clay loam that in most places is limy in the lower part. The underlying material is light yellowish-brown to light-gray glacial material of clay loam or sandy clay loam texture. A few cobblestones and small stones occur in many places.

Minor in this association are the Mayberry, Malcolm, Hobbs, and Hastings soils. Mayberry soils have a clayey subsoil and are at higher elevations on the landscape. Malcolm soils are silty and are at lower elevations on

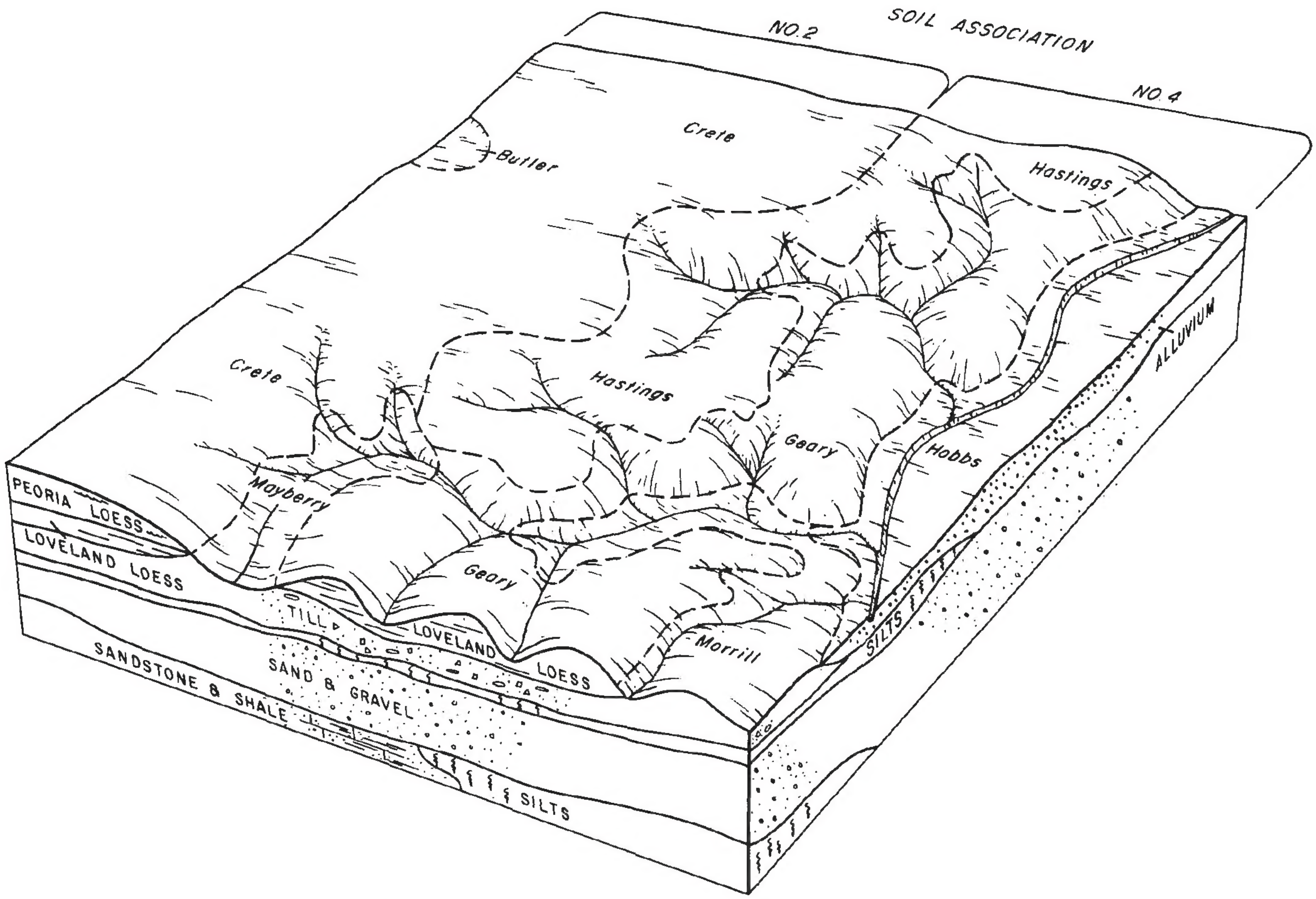

Figure 4.—**Typical pattern of soils and parent material in the Crete-Mayberry and Geary-Hastings associations.**

the sides of drainageways. Hobbs soils are on bottom lands of drainageways. Hastings soils are at higher elevations and formed in loess.

The nearly level and gently sloping soils are mainly cultivated. The more sloping soils, mostly along intermittent drainageways, are mainly in native grass and are used for range. Corn, grain sorghum, wheat, and alfalfa are the main crops. Water erosion is a hazard on the sloping soils. The main concerns in management are controlling runoff, reducing the risk of erosion, and conserving moisture. A vigorous stand of grass and proper use are the main concerns in managing range.

Nearly all farms are of a combination cash grain-livestock type and range from 240 acres to 640 acres in size. Markets for farm produce are readily available in nearby towns within the county or in adjacent counties. Most section lines have gravel roads, but some have only dirt roads or trails.

4. Geary-Hastings Association

Gently sloping to steep, deep silty soils on loess uplands

This association consists of mainly gently sloping to steep soils on ridgetops and sides of intermittent drainageways in loess uplands (see fig. 4). Buckley Creek and its tributaries are the main drainageways in the association.

The total area of this association is about 24,500 acres, or nearly 6 percent of the county. It is about 56 percent Geary soils, 41 percent Hastings soils, and 3 percent soils of minor extent.

Soils of the Geary series are deep, moderately sloping to steep, well-drained soils that formed in loess. They are below Hastings soils on the landscape. The surface layer is dark grayish-brown silty clay loam. The subsoil is reddish-brown silty clay loam that is more reddish with increasing depth. The underlying material is generally noncalcareous, reddish-yellow loess of silty clay loam texture.

Soils of the Hastings series are deep, gently sloping to strongly sloping, well-drained soils that formed in loess. They are above the Geary soils on the landscape. The surface layer is dark-gray silt loam, and the subsoil is grayish-brown silty clay loam. The underlying material is calcareous, light yellowish-brown or very pale brown loess of silt loam texture.

Minor in this association are the Crete, Morrill, and Hobbs soils. Crete soils have a clayey subsoil, are nearly level and gently sloping and are on upland flats. Morrill soils are at lower elevations and formed in reworked

glacial till. Hobbs soils are at the lowest elevations on the landscape, on bottom lands of narrow, intermittent drainageways.

Most of this association is cultivated. The strongly sloping to steep areas are generally in native grass and are used for range. Grain sorghum, corn, wheat, and alfalfa are the main crops. The main concerns in management are conserving moisture, controlling runoff, and reducing the risk of erosion. Maintaining a vigorous stand of grasses is the main concern in range management.

Farms range from 160 to 480 acres in size and nearly all are of the cash-grain or a combination of cash-grain and general livestock types. Good gravel roads are on most section lines. Markets for farm produce are available in nearby towns within the county and in adjacent counties.

5. Geary-Jansen Association

Moderately sloping to steep, deep silty and loamy soils that formed in loess, and moderately sloping to steep loamy soils that are moderately deep over gravel; on uplands

This association consists of gently rolling to steep soils on ridges and valley sides of the Little Blue River and its tributaries (see fig. 2). The landscape is irregular, and hillsides are cut by numerous uncrossable gullies.

The total area of this association is about 30,000 acres, or nearly 8 percent of the county. It is about 51 percent Geary soils, 40 percent Jansen soils, and 9 percent soils of minor extent.

Soils of the Geary series are deep, moderately sloping to steep, well-drained soils that formed in loess or loamy material. They are on the rolling ridgetops and some of the steeper sides of ridges. The surface layer is dark grayish-brown silty clay loam. The subsoil is reddish-brown silty clay loam that is more reddish with increasing depth. The underlying material is reddish-yellow loess of silty clay loam texture. In some places it contains mixed sand and gravel in the lower part.

Soils of the Jansen series are moderately deep, well-drained, moderately sloping to steep soils that formed in reworked loess over mixed sand and gravel. The surface layer is generally grayish-brown loam; in places it is fine sandy loam. The subsoil is brown sandy clay loam. The depth to the underlying mixed sand and gravel ranges from 20 to 40 inches.

Minor in this association are the Meadin, Hastings, and Hobbs soils. Meadin soils are shallow over sand and gravel. They are at lower elevations and are steeper than Hastings and Hobbs soils. Hastings soils are at higher elevations, and Hobbs soils are in the bottoms of drainageways.

Most of the moderately sloping soils in this association are cultivated. Grain sorghum and wheat are the most common crops. The main concerns in management are conserving moisture, controlling runoff, and reducing the risk of erosion. The strongly sloping and steep soils are generally in native grass and are used for range. A vigorous stand of grass and proper range use are the main concerns in managing rangeland.

Farms range from 240 to 640 acres in size and nearly all are of the combination cash-grain and general livestock type. Adequate markets for farm produce are available in nearby towns within the county and in adjacent counties. Good gravel roads are on most section lines.

6. Benfield-Kipson Association

Moderately sloping to steep, moderately deep and shallow silty soils that have a clayey to silty subsoil; on limestone uplands

This association consists of a strongly rolling to rough broken area in the limestone uplands (fig. 5). Deep intermittent drainageways cross the area. Some of the area is rough and rocky. The soils range from moderately sloping to steep.

The total area of this association is about 17,500 acres, or slightly more than 5 percent of the county. It is about 58 percent Benfield soils, 38 percent Kipson soils, and 4 percent soils of minor extent.

Soils of the Benfield series are moderately deep, well-drained, moderately sloping to steep soils that formed in weathered limestone and loess. They are on rolling ridgetops above the steeper Kipson soils or on foot slopes below them. The surface layer is dark-gray silty clay loam. The subsoil is light yellowish-brown silty clay that grades to olive gray or dark brown in the lower part. The underlying bedrock is limestone interbedded with limy shale. The upper part is partly weathered. Small fragments of limestone occur throughout the soil.

Soils of the Kipson series are shallow, somewhat excessively drained, strongly sloping to steep soils that formed in a thin layer of loess and weathered limestone. Most Kipson soils are sharply rolling. The surface layer is gray, calcareous silt loam. The transitional layer is light brownish-gray silt loam that grades rapidly to the underlying weathered limestone or limy shale. The upper part of the underlying material is sufficiently fragmented to permit some root penetration.

Minor in this association are the Lancaster, Geary, and Hobbs soils. Lancaster soils formed in sandstone and are at lower elevations on sides of deep drainageways. Geary soils formed in loess and are at higher elevations than the Benfield soils. The nearly level Hobbs soils formed in alluvium and are on bottom lands of the broader drainageways.

Most of this association is in native grasses and is used for range and hay. Maintaining a vigorous stand of grass is the main concern in management. Some areas of the moderately sloping Benfield soils are cultivated. Grain sorghum, alfalfa, and wheat are the most common crops. Water erosion is a hazard in cultivated areas. Controlling runoff, reducing the risk of erosion, and conserving moisture are concerns in management.

Farms range from 240 to 960 acres in size. Nearly all farms are of the general livestock type. Some are a combination cash grain-livestock type. Markets are readily available in nearby towns within the county or in adjacent counties. Good gravel roads are limited and do not always follow section lines. Dirt roads or trails are on some section lines.

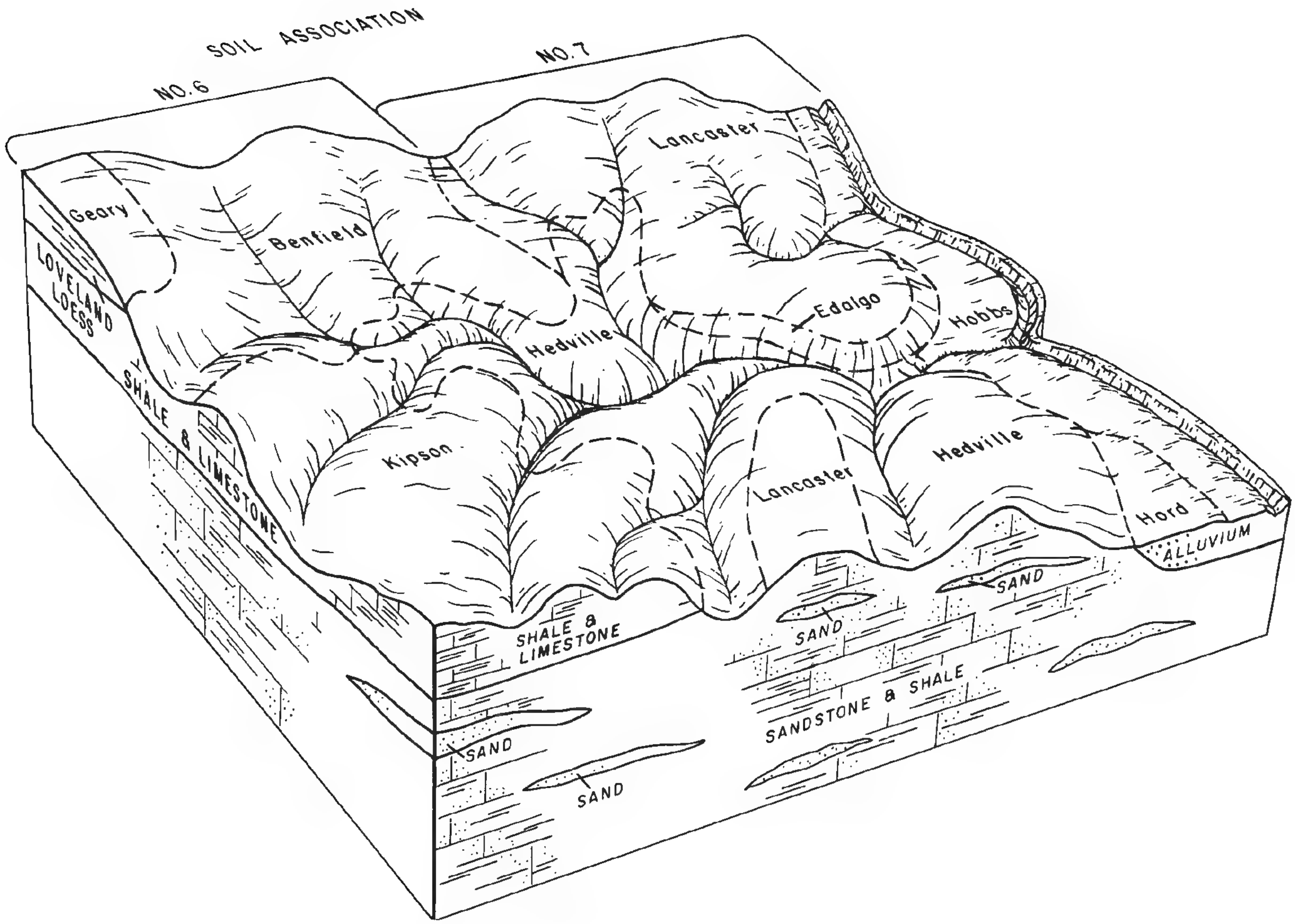

Figure 5.—**Typical pattern of soils and parent material in the Benfield-Kipson and Lancaster-Hedville associations.**

7. Lancaster-Hedville Association

Moderately sloping to steep, moderately deep and shallow loamy soils on sandstone and sandy shale uplands

This association consists of an area of sandstone and shale uplands that is generally moderately sloping to steep and has broken relief (see fig. 5). Erosion of the soft sandstone formed an intricate system of deep drainageways.

The total area of this association is about 29,000 acres, or slightly more than 8 percent of the county. It is about 69 percent Lancaster soils, 11 percent Hedville soils, and 20 percent soils of minor extent.

Soils of the Lancaster series are moderately deep, well-drained, moderately sloping to steep soils that formed in weathered sandstone and shale. They generally are on rolling divides at a higher elevation than the steeper Hedville soils or on foot slopes at a lower elevation. The surface layer is dark grayish-brown to reddish-brown loam. The subsoil is yellowish-brown clay loam that grades to brownish yellow or light gray with increasing depth. The underlying material is stratified reddish-yellow weathered sandstone and light-gray sandy shale. Sandstone fragments are numerous throughout the soil.

Soils of the Hedville series are shallow, somewhat excessively drained, strongly sloping to steep soils that formed in weathered sandstone and shale. They are on the nearly vertical blufflike areas on sides of drainageways and on the sharper, gullied divides. They have a dark-gray loam surface layer and a varicolored subsurface layer of sandy loam. This is underlain by reddish-brown sandstone interbedded with gray clayey shale. Sandstone fragments are numerous on the surface and throughout the soil.

Minor in this association are the Geary, Edalgo, Hord, and Hobbs soils and Rough stony land. Geary soils formed in loess and are generally at higher elevations on the landscape. Edalgo soils formed in clayey shale on the lower sides of drainageways. Hord soils are deep, dark alluvial soils on the high benches of the major streams. Hobbs soils are alluvial and are on the wide bottoms of drainageways. In areas of Rough stony land erosion has removed most of the weathered soil material, and sandstone is exposed on the steeper slopes.

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Nearly all of this association is in native grass and is used for range. Proper range use and maintaining a vigorous stand of grass are concerns in range management. Some areas of the moderately sloping and strongly sloping Lancaster soils are cultivated. Grain sorghum and wheat are the most common crops. Water erosion is a hazard. The main concerns in management are controlling runoff, reducing the risk of erosion, and conserving moisture.

Farms range from 240 to 960 acres in size. Nearly all farms are of the general livestock type. Some are of the cash grain-livestock type. Markets are readily available in nearby towns within the county or in adjacent counties. Good gravel roads are limited and do not always follow section lines. Dirt roads or trails are on the same section lines.

Descriptions of the Soils

This section describes the soil series and mapping units in Jefferson County. Each soil series is described in considerable detail. and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to laymen. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are of a soil series. Silty alluvial land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, windbreak suitability group, and range site in which the mapping unit has been placed. The page for the description of each capability unit, windbreak suitability group, and range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Some soil boundaries may not match adjoining areas in adjacent counties. These differences result from changes in slope groupings, in combinations of mapping units, or in correlation procedures that occur in soil classification and in mapping guide lines.

Benfield Series

The Benfield series consists of moderately sloping to steep, moderately deep, well-drained soils that formed partly in material weathered from limy shale and limestone and partly in thin deposits of loess. These soils are on uplands, mainly above deep drainageways.

In a representative profile the surface layer is dark-gray silty clay loam about 7 inches thick. The upper 5 inches of the subsoil is grayish-brown silty clay loam, and the lower 12 inches is light yellowish-brown, firm silty clay. The subsoil is more compact than the surface layer. The next layer is about 4 inches of reddish-yellow or olive-gray weathered shale. The lower part contains many nodules of lime and angular fragments of limestone. At a depth of 28 inches is partly weathered limestone interbedded with mottled limy shale.

Permeability is moderately slow to slow. Natural fertility is medium to high. Available water capacity is low.

Most of the moderately sloping and strongly sloping soils are cultivated, and the steep soils are used for hay and pasture. The native vegetation is mainly grass and scattered oak. The soils puddle if worked or trampled when wet.

Representative profile of Benfield silty clay loam, 7 to 11 percent slopes, in a field of native grass, 0.25 mile east and 0.15 mile south of the northwest corner of sec. 21, T. 1 N., R. 1 E.

A—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; mildly alkaline; strong effervescence; clear, smooth boundary.

B1—7 to 12 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; mildly alkaline; strong effervescence; clear, smooth boundary.

B2t—12 to 24 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; hard, firm; violent effervescence; moderately alkaline; few, small, hard lime concretions; clear, smooth boundary.

C1—24 to 28 inches, reddish-yellow (7.5YR 6/6) to olive-gray (5Y 5/2) to dark-brown, (7.5YR 4/4) weathered clayey shale, varicolored olive gray (5Y 4/2) to olive yellow (5Y 6/6) to reddish yellow (7.5YR 6/8) moist; moderate, medium, platy structure parting to moderate, thin, platy structure; hard, friable; violent effervescence; moderately alkaline; few lime concretions and small limestone fragments; gradual, wavy boundary.

C2—28 to 40 inches, dark-gray (5Y 4/1) to pale-olive (5Y 6/3) limy shale; varicolored light brownish gray (2.5Y 6/2) to dark grayish brown (2.5Y 4/2) to reddish yellow (7.5YR 6/8) moist; massive; very hard, firm; violent effervescence.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Benfield silty clay loam, 3 to 7 percent slopes, eroded	4,417	1.0
Benfield silty clay loam, 7 to 11 percent slopes	1,463	.4
Benfield silty clay loam, 7 to 11 percent slopes, eroded	1,596	.5
Benfield silty clay loam, 11 to 30 percent slopes	1,777	.6
Burchard clay loam, 3 to 7 percent slopes	457	.1
Burchard clay loam, 7 to 11 percent slopes	2,259	.7
Burchard clay loam, 7 to 11 percent slopes, severely eroded	1,629	.5
Burchard clay loam, 11 to 30 percent slopes	1,186	.3
Butler silt loam	4,752	1.3
Cass loam	455	.1
Cass loam, occasionally flooded	1,980	.6
Crete silt loam, 0 to 1 percent slopes	52,735	14.3
Crete silt loam, 1 to 3 percent slopes	47,053	12.7
Crete silt loam, 7 to 11 percent slopes	879	.3
Crete silty clay loam, 3 to 7 percent slopes, eroded	56,779	15.3
Edalgo silty clay loam, 3 to 7 percent slopes, eroded	484	.1
Edalgo silty clay loam, 7 to 11 percent slopes	398	.1
Geary silty clay loam, 3 to 7 percent slopes	2,270	.7
Geary silty clay loam, 3 to 7 percent slopes, eroded	11,592	3.2
Geary silty clay loam, 7 to 11 percent slopes	1,721	.5
Geary silty clay loam, 3 to 11 percent slopes, severely eroded	4,723	1.2
Geary silty clay loam, 11 to 30 percent slopes	3,972	1.0
Geary and Jansen soils, 5 to 11 percent slopes	2,522	.7
Geary and Jansen soils, 5 to 11 percent slopes, eroded	2,950	.8
Geary and Jansen soils, 5 to 11 percent slopes, severely eroded	2,590	.7
Geary and Jansen soils, 11 to 30 percent slopes	4,309	1.1
Gravel pits	477	.1
Hastings silt loam, 1 to 3 percent slopes	1,620	.5
Hastings silt loam, 3 to 7 percent slopes	1,490	.4
Hastings silt loam, 7 to 11 percent slopes	430	.1
Hastings silty clay loam, 3 to 7 percent slopes, eroded	15,798	4.2
Hastings silty clay loam, 3 to 11 percent slopes, severely eroded	5,619	1.5
Hedville loam, 7 to 30 percent slopes	3,129	.8
Hobbs silt loam, 0 to 1 percent slopes	11,578	3.1
Hobbs silt loam, occasionally flooded	18,933	5.1
Hobbs silt loam, 1 to 3 percent slopes	7,297	2.0
Hord silt loam, 0 to 1 percent slopes	3,051	.8
Hord silt loam, 1 to 3 percent slopes	260	.1
Jansen loam, 3 to 7 percent slopes	1,053	.2
Jansen loam, 3 to 7 percent slopes, eroded	1,029	.2
Jansen loam, 7 to 11 percent slopes	401	.1
Kipson silt loam, 7 to 30 percent slopes	5,285	1.4
Lancaster loam, 3 to 7 percent slopes, eroded	3,206	.8
Lancaster loam, 7 to 11 percent slopes	2,795	.7
Lancaster soils, 7 to 11 percent slopes, severely eroded	1,893	.5
Lancaster and Edalgo soils, 11 to 30 percent slopes	11,574	3.1
Malcolm silt loam, 7 to 11 percent slopes, eroded	220	.1
Mayberry silty clay loam, 3 to 7 percent slopes, eroded	13,706	3.7
Mayberry silty clay loam, 7 to 11 percent slopes	1,975	.5
Mayberry clay, 3 to 11 percent slopes, severely eroded	5,654	1.5
Meadin loam, 7 to 30 percent slopes	1,707	.4
Morrill clay loam, 3 to 7 percent slopes	2,205	.6
Morrill clay loam, 3 to 7 percent slopes, eroded	5,606	1.6
Morrill clay loam, 7 to 11 percent slopes	2,913	.8
Morrill clay loam, 11 to 30 percent slopes	5,179	1.5
Morrill soils, 3 to 11 percent slopes, severely eroded	3,697	1.0
Rough stony land	2,581	.7
Sandy alluvial land	212	.1
Silty alluvial land	8,157	2.5
Wet alluvial land	85	(1)
Water	1,517	.5
Total	369,280	100.0

1 Less than 0.05 percent.

The depth to bedrock ranges from 20 to 40 inches. The B2t horizon in the deeper soils ranges from silty clay to clay. In some places the soils formed almost entirely in residuum weathered from limestone, whereas in others they have a thin capping of loess.

Benfield soils are associated with Kipson and Lancaster soils. They are deeper over bedrock than Kipson soils, which have more limestone and less clayey shale in the underlying material. They formed in limestone, whereas Lancaster soils formed in sandstone and sandy shale.

Benfield silty clay loam, 3 to 7 percent slopes, eroded (BfB2).—This soil is on low ridges and the short sides of intermittent drainageways below and above the steeper breaks of Kipson soil. Included in mapping are small areas of shallow Kipson soil among outcrops of limestone.

The organic-matter content is moderately low. Natural fertility is high. Runoff is medium. The underlying material limits root penetration and slows water movement.

The acreage of this Benfield soil is about equally divided between cropland and native grassland. Reducing runoff, conserving moisture, and controlling erosion are the main management needs in cultivated areas. Wheat, corn, grain sorghum, and alfalfa are the most commonly grown crops. Some crops, chiefly corn and grain sorghum, are irrigated with the limited supply of water from farm ponds. Maintaining fertility and managing water effectively are special concerns in irrigated areas. A vigorous stand of grass and proper range use are essential in areas used as range. Capability units IIIe-2, dryland and IIIe-21, irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Benfield silty clay loam, 7 to 11 percent slopes (BfC).—This soil is mainly on the short slopes below the shallow, steep soils over limestone. Slopes are concave. It has the profile described as representative of the series. As much as 20 percent of some mapped areas consists of the Kipson soil that is shallow over limy shale and limestone and occasional outcrops of limestone.

Organic-matter content is moderate, and natural fertility is high. Runoff is medium. The underlying material limits root penetration and restricts water movement.

Most of the acreage is in native grasses and is used for hay or as range. Maintaining a vigorous stand of grasses is the main management need. This soil is suited to cultivated crops. Conserving moisture, reducing runoff, and controlling erosion are the main management

concerns in cultivated areas. Capability unit IVe-2, dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Benfield silty clay loam, 7 to 11 percent slopes, eroded (BfC2).—This soil is on short concave slopes below the shallow, steep soils over limestone. It has a profile similar to the one described as representative of the series, but the erosion has thinned the surface layer. The surface layer is about 5 inches thick and calcareous. Numerous limestone fragments are on the surface. Varying degrees of erosion in cultivated areas give these areas a patchy appearance. In some places light yellowish-brown subsoil has been mixed into the darker colored original surface layer. Included with this soil in mapping are areas of shallow Kipson soil over limy shale and limestone. These included areas are 20 percent of the mapped areas.

Runoff is rapid. Natural fertility is medium, and organic-matter content is moderately low. The underlying material somewhat limits root penetration and restricts water movement.

Most of the acreage is cultivated. This soil is better suited to wheat and alfalfa than to other crops, but grain sorghum can be grown occasionally. Reducing runoff, controlling erosion, conserving moisture, and maintaining fertility are the principal management needs. This soil is also suitable for range and can be seeded to native grasses. Capability unit IVe-2, dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Benfield silty clay loam, 11 to 30 percent slopes (BfD).—This steep soil is in the upper part of intermittent drainageways. This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner. As much as 25 percent of some mapped areas consists of Kipson soil that is shallow over limy shale. The depth to bedrock in areas of this soil ranges from 15 to 30 inches.

Natural fertility is medium, and the organic-matter content is moderate. Runoff is generally rapid but depends on the amount of vegetative cover. The underlying material limits root penetration and restricts water movement.

This soil is not suited to cultivation because of the steep slopes. Most of the acreage is in native grasses and is used as range. Maintaining a vigorous stand of grass and reducing runoff are the main management needs. Capability unit VIe-1, dryland; Silty range site; Silty to Clayey windbreak suitability group.

Burchard Series

The Burchard series consists of moderately sloping to steep, deep, well-drained soils on uplands. These soils formed in calcareous glacial till (fig. 6). The native vegetation consists of mid and tall grasses.

In a representative profile the surface layer is dark grayish-brown clay loam about 10 inches thick. The upper part of the subsoil is about 4 inches of dark grayish-brown clay loam; the middle 12 inches is pale-brown, friable silty clay loam; and the lower 6 inches is light yellowish-brown, friable silty clay loam. The lower part of the subsoil is calcareous and has pockets and channels of soft white lime extending into the layer below. The underlying material, which begins at a depth of 32 inches, is light yellowish-brown or light-gray clay loam. Carbonates are abundant in the upper part and decrease with increasing depth.

***Figure 6.*—Profile of Burchard clay loam showing accumulation of lime in lower part of subsoil. The scale is marked in feet and inches.**

Permeability is moderately slow. Natural fertility is medium to high. Available water capacity is high.

The less sloping areas of these soils are well suited to cultivation. The more sloping areas are used mainly as range.

Representative profile of Burchard clay loam, 7 to 11 percent slopes, under native grass, 528 feet south and 100 feet east of the northwest corner of sec. 12, T. 3 N., R. 4 E.

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, very friable; neutral; clear, smooth boundary.

B1—10 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

B2t—14 to 26 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slight effervescence; moderately alkaline; clear, smooth boundary.

B3—26 to 32 inches, light yellowish-brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate, coarse, subangular blocky structure parting to moderate,

medium, subangular blocky structure; hard, firm; violent effervescence, mainly because of pockets and channels of soft lime; moderately alkaline; clear, smooth boundary.

C1—32 to 42 inches, 50 percent light-gray (2.5Y 7/2) and 50 percent light yellowish-brown (10YR 6/4) clay loam, light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; very hard, firm; violent effervescence, mainly because of pockets of lime; moderately alkaline; clear, smooth boundary.

C2—42 to 52 inches, 20 percent light yellowish-brown (10 YR 6/4) and 80 percent light gray (2.5 7/2) clay loam, yellowish brown (10YR 5/6) and light brown gray (2.5Y 6/2) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; very hard, firm; strong effervescence; moderately alkaline.

The depth to lime ranges from 13 to 36 inches. The severely eroded Burchard soil in mapping unit BdC3 has a lighter colored surface layer than is defined as the range for the series. This does not alter the usefulness of behavior of the soil.

Burchard soils are associated with Morrill and Mayberry soils. They have carbonates in the upper 40 inches, but Morrill soils are leached of carbonates to a depth of more than 40 inches. They have less clay in the B horizon than Mayberry soils, which also are leached of carbonates to a depth of more than 40 inches.

Burchard clay loam, 3 to 7 percent slopes (BdB).—This soil is on ridges between intermittent drainageways. It has a profile similar to the one described as representative of the series, but has a thinner surface layer. Included in mapping are small areas of eroded soils.

Runoff is medium. Organic-matter content is moderate. Naturally fertility is high.

Most of the acreage is cultivated. This soil is suited to most of the commonly grown crops. Grain sorghum, wheat, corn and alfalfa are the principal dryland crops. Reducing runoff, controlling erosion, and conserving moisture are the main management needs. The principal irrigated crops are grain sorghum and corn. Maintaining fertility and managing water are the main concerns where this soil is irrigated. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Burchard clay loam, 7 to 11 percent slopes (BdC).—This soil is on lower slopes along intermittent drainageways. It has the profile described as representative of the Burchard series. Small boulders or rocks are in the surface layers and are partly exposed in some places. Included in mapping are small areas of Morrill soils.

Runoff is medium. Organic-matter content is moderate, and natural fertility is high.

This soil is suitable for cultivation, but most areas are in native grass. Keeping a vigorous stand of grass is the management need in areas used as range. Grain sorghum, corn, wheat, and alfalfa are the principal dryland crops. Reducing the hazard of erosion, conserving moisture, and maintaining fertility are the main management needs in cultivated areas. Capability unit IVe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Burchard clay loam, 7 to 11 percent slopes, severely eroded (BdC3).—This soil is on the lower parts of some hillsides along intermittent drainageways. Its surface layer is lighter colored and about 6 inches thinner than the one described in the profile representative of the series. The subsoil has been mixed into the plow layer in most areas. Included in mapping are small areas of Morrill soils.

Runoff is rapid. This soil is medium to low in fertility and low in content of organic matter. Rills and small gullies are common in cultivated fields following heavy rains.

Most areas are cultivated, but some are in native grasses. Grain sorghum, wheat, corn, and alfalfa are suitable crops. Improving fertility, reducing runoff, controlling erosion, and conserving moisture are the principal management needs in cultivated areas. Capability unit IVe–8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Burchard clay loam, 11 to 30 percent slopes (BdE).—This steep soil is on the sides of intermittent drainageways. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are thinner. Slopes are irregular. They are dominantly about 18 percent, but range from 11 to 40 percent. As much as 25 percent of some mapped areas consist of the associated Morrill soil.

Runoff is medium to rapid depending on the vegetative cover. Organic-matter content is moderate.

Most areas are in native grass and are used as range. Keeping grass vigorous, reducing runoff, and controlling grazing are the principal management needs. Capability unit VIe—1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Butler Series

The Butler series consists of deep, somewhat poorly drained soils that have a compact clayey subsoil. These nearly level soils formed in silty calcareous loess under prairie vegetation in slight depressions. They receive runoff from higher lying soils.

In a representative profile the upper part of the surface layer is gray silt loam about 5 inches thick, and the lower part is dark-gray silt loam about 4 inches thick. The thin subsurface layer is light-gray, leached silt loam. The upper part of the subsoil is dark-gray, very firm clay about 29 inches thick, and the lower part is light olive-gray silty clay loam about 6 inches thick. The subsoil is sticky when wet, compact when moist, and very hard when dry. The underlying material is light olive-gray, calcareous heavy silt loam.

Permeability is slow. Natural fertility is medium. Available water capacity is high.

Most of the acreage is cultivated. These soils are suited to irrigation but require smaller and more frequent applications of water than do soils that have a more permeable subsoil.

Representative profile of Butler silt loam in a cultivated field, 792 feet east and 100 feet north of the southwest corner of sec. 17, T. 4 N., R. 4 E.

Ap—0 to 5 inches, gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.

A12—5 to 9 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A2—9 to 11 inches, light-gray (10YR 7/1) silt loam, dark gray (5Y 4/1) moist; weak, medium, subangular blocky structure parting to weak, medium, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

B21t—11 to 32 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, coarse, prismatic structure parting to strong, medium, subangular blocky structure; very hard, very firm; neutral; clear, smooth boundary.

B22t—32 to 40 inches, dark-gray (10YR 4/1) clay, very dark brown (10YR 2/2) moist; strong, coarse, prismatic structure parting to strong, medium, subangular blocky structure; very hard, very firm; neutral; clear, smooth boundary.

B3—40 to 46 inches, light olive-gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; hard, firm; numerous iron stains; neutral; clear, smooth boundary.

C—46 to 60 inches, light olive-gray (5Y 6/2) heavy silt loam, olive (5Y 5/3) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; slight effervescence; numerous iron stains.

The A horizon ranges from 8 to 12 inches in thickness. The B horizon is clay or silty clay loam 16 to 36 inches thick. It is 45 to 55 percent clay.

Butler soils are associated with the Crete and Hastings soils. They differ from the well-drained Crete and Hastings soils in lacking the well-defined A2 horizon and they are finer textured in the B horizon.

Butler silt loam (0 to 1 percent slopes) (Bu).—This soil is in irregularly shaped areas in slight depressions in the uplands. Slope is generally less than 1 percent. Runoff from adjacent areas of Crete and Hastings soils accumulates on this soil for short periods. Included in mapping are poorly drained soils in small depressions.

This Butler soil compacts readily if it is worked or grazed when wet. Runoff is very slow. Organic-matter content is moderate. The accumulation of water and very slow surface drainage are the main management concerns. Wetness delays fieldwork.

The soil is droughty during periods of low rainfall, because water movement is slow and root penetration is limited in the clayey subsoil. Maintaining fertility, land grading, and managing water are special concerns in irrigated areas.

Most of the acreage is cultivated. Wheat and grain sorghum are the principal dryland crops, and corn and grain sorghum are the principal irrigated crops. Capability units IIw–2 dryland and IIs–21 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Cass Series

The Cass series consists of deep, nearly level, well-drained soils that formed in recent alluvium. These soils are mainly on the bottom lands along the Big Blue River. The depth of the water table ranges from 5 to 10 feet.

In a representative profile the surface is dark-gray loam about 12 inches thick. The next layer is friable, light brownish-gray loan about 4 inches thick. The upper 17 inches of the underlying material consists of light brownish-gray friable fine sandy loam that gradually grades to light-gray loamy sand at a depth of 38 inches.

Permeability is moderately rapid. Available water capacity is low. Natural fertility is medium to low. The lower lying areas of these soils are subject to occasional flooding.

Most areas are cultivated, but some are wooded pasture close to streams. These soils are well suited to irrigation but are not extensively irrigated because flooding is a hazard.

Representative profile of Cass loam, occasionally flooded, under native grass, 100 feet south and 100 feet west of northeast corner of southeast quarter of sec. 18, T. 3 N., R. 1 E.

A—0 to 12 inches, dark-gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

AC—12 to 16 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky structure; soft, very friable; neutral; clear, smooth boundary.

C1—16 to 33 inches, light brownish-gray (10YR 6/2) fine sandy loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky structure; loose, friable; neutral; clear, smooth boundary.

C2—33 to 52 inches, light-gray (10YR 7/2) loamy sand, pale brown (10YR 6/3) moist; single grained; loose; few brown iron stains; neutral.

The A horizon ranges from 10 to 18 inches in thickness. Thin strata of sandy and silty material are in some places. The C horizon generally becomes coarser textured with increasing depth. The elevation of the Cass soils above the stream channel determines the frequency of flooding. Depth to the moderately coarse material ranges from 12 to 20 inches.

Cass soils are associated with Hobbs soils. They are coarser textured below the A horizon than the Hobbs soils.

Cass loam (0 to 1 percent slopes) (Cm).—This soil is in scattered areas on the high bottom lands of the Big Blue River. It is seldom flooded. Included in mapping are small areas of soils that have a fine sandy loam surface layer.

The workability of the Cass soil is good. Runoff is slow to medium. Extremely high floodwaters cover some areas of this soil. Organic-matter content is moderate.

Most of the acreage is cultivated. Grain sorghum, corn, alfalfa, and wheat are the main crops. Improving fertility and conserving moisture are the principal management needs. Grain sorghum and corn respond well to irrigation, but water management is needed. Capability units I–1 dryland and I–1 irrigated; Silty Lowland range site; Moderately Wet windbreak suitability group.

Cass loam, occasionally flooded (0 to 1 percent slopes) (2Cm).—This soil is on bottom lands that are flooded once or twice a year in about 3 out of every 5 years. It commonly is in long, narrow areas that parallel the major streams. This soil has the profile described as representative of the series. Included in mapping are small areas of soil that have a fine sandy loam surface layer.

This Cass soil is friable and easily tilled. Crops are damaged by floodwater and by the silt and sand deposited as the water recedes. Runoff is slow. Organic-matter content is moderate.

Most of the acreage is cultivated. Grain sorghum, corn and alfalfa are the principal crops. Controlling flooding, maintaining fertility, and improving organic-matter content are the main management needs. Flooding delays tillage. Wheat is not grown extensively because flooding

is a hazard in spring. Grain sorghum and corn are the principal irrigated crops. Water management is the main management need in irrigated areas. Capability units IIw-3 dryland and I-2 irrigated; Silty Overflow range site; Moderately Wet windbreak suitability group.

Crete Series

The Crete series consists of deep, nearly level to strongly sloping, moderately well drained soils that have a claypan. These soils are on uplands. They formed in medium-textured loess. The native vegetation consists mainly of tall and mid grasses.

In a representative profile the surface layer is gray silt loam about 10 inches thick. The subsoil, about 25 inches thick, is dark-gray, firm silty clay in the upper part and grayish-brown, firm silty clay in the middle part. The lower part is light olive-gray friable, calcareous silty clay loam, is about 6 inches thick, has a few iron stains, and contains segregations of soft lime that decrease with increasing depth. The underlying material is light brownish-gray, mottled, calcareous silt loam.

Natural fertility is medium to high. Permeability is slow. Available water capacity is high. The claypan causes these soils to absorb water slowly, making them somewhat droughty.

Most of the acreage is cultivated. These are the most extensively irrigated soils in Jefferson County. Grain sorghum and corn are the principal irrigated crops, and wheat and grain sorghum are the principal dryland crops. Small areas are in native range.

Representative profile of Crete silt loam, 0 to 1 percent slopes, in a cultivated field, 200 feet south and 200 feet east of northwest corner, sec. 26, T. 3 N., R. 2 E.

Ap—0 to 5 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A1—5 to 10 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to weak, medium, granular structure; soft, friable; slightly acid; clear, smooth boundary.

B21t—10 to 22 inches, dark-gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, blocky structure; thin clay films; hard, firm; neutral; clear, smooth boundary.

B22t—22 to 29 inches, grayish-brown 10YR 5/2) silty clay, dark brown (10YR 3/3) moist; moderate, coarse, blocky structure parting to moderate, medium, blocky structure; thin clay films; hard, firm; mildly alkaline; slight effervescence in lower part; clear, smooth boundary.

B3—29 to 35 inches, light olive-gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; weak, coarse, subangular blocky structure parting to weak, medium, subangular blocky structure; slightly hard, friable; few fine iron stains; violent effervescence; moderately alkaline; soft lime segregations; clear, smooth boundary.

C—35 to 60 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; few, faint, grayish and yellowish-brown mottles; weak, coarse, prismatic structure parting to weak, fine, subangular blocky structure; few soft lime concretions; slightly hard, friable; strong effervescence; moderately alkaline.

The A horizon ranges from 8 to 13 inches in thickness. The B horizon is silty clay loam or silty clay. The clay content of the B2 horizon ranges from 45 to 52 percent. The clay films on the vertical and horizontal faces of the peds are generally darker than the crushed color. Depth to the lime accumulation ranges from 27 to 32 inches.

Crete soils are associated with Hastings, Butler, and Geary soils. Their B21 horizon is more clayey than that of Hastings and Geary soils. Crete soils are better drained than Butler soils, which have an A2 horizon and a thicker B horizon.

Crete silt loam, 0 to 1 percent slopes (Ce).—This soil is on uplands. It has the profile described as representative of the series. Included in mapping are areas of Butler soils in small depressions.

This Crete soil is somewhat droughty because the fine-textured subsoil releases water to plants slowly. Runoff is slow. Natural fertility is medium. This soil puddles readily if worked or trampled when wet, but it retains its good structure if it is well managed.

Most of the acreage is cultivated. This soil is better suited to wheat and sorghum than to corn. Maintaining organic-matter content and fertility is the main management needed. All crops, and especially corn, respond well to irrigation. Careful control of water and maintenance of fertility are the main concerns of management in irrigated areas. Capability units IIs-2 dryland and IIs-2 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Crete silt loam, 1 to 3 percent slopes (CeA).—This soil is on broad ridgetops. It has a claypan. Included in mapping are small areas of eroded soils that have a silty clay loam surface layer.

Organic-matter content is moderate and natural fertility is high. Runoff is medium, and the hazard of erosion is slight to moderate.

Most of the acreage is cultivated. Wheat, grain sorghum, and alfalfa are the principal dryland crops, and corn and grain sorghum are the principal irrigated crops. Conserving moisture and reducing runoff are the main management needs. Crops respond well to irrigation. Maintaining fertility and managing water are special management needs in irrigated areas. Capability units IIe-2 dryland and IIIe-2 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Crete silt loam, 7 to 11 percent slopes (CeC).—Areas of this strongly sloping claypan soil are small and scattered. This soil has a profile similar to the one described as representative of the series, but it has a thinner surface layer and subsoil. As much as 20 percent of some mapped areas consists of Hastings soils.

Organic-matter content is moderate. Runoff is medium to rapid. The subsoil ranges from silty clay to silty clay loam. This soil is only slightly eroded.

Most areas are in native grass and used as range. Keeping grass vigorous, reducing runoff, and controlling grazing are the principal management needs. This soil is suitable for cultivation. Wheat, grain sorghum, and alfalfa are the principal dryland crops. Controlling erosion, controlling runoff, conserving moisture, and maintaining fertility are the main management needs in cultivated areas. Capability unit IVe-2 dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Crete silty clay loam, 3 to 7 percent slopes, eroded (CrB2).—This soil is on hillsides and ridges. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam about 5 inches thick. It is moderately eroded in most places. In a few

places it is severely eroded and has a lighter colored surface layer than is typical. As much as 15 percent of some mapped areas consists of Hastings soils.

Natural fertility is medium, and the organic-matter content is moderately low. Runoff is medium.

Most of the acreage is cultivated. Wheat, grain sorghum, corn, and alfalfa are the principal dryland crops. Maintaining good tilth, conserving water, controlling erosion, and maintaining fertilty are management needs in cultivated areas. Corn and grain sorghum are grown under irrigation, but the acreage is small. Managing water and maintaining fertility are special management concerns in irrigated areas. Capability units IIIe–2 dryland and IIIe–21 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Edalgo Series

The Edalgo series consists of moderately deep, moderately sloping to steep, well-drained soils on uplands. These soils formed in material weathered from clayey shale that has variegated colors of yellow, light gray, and reddish brown (fig. 7).

In a representative profile the surface layer is grayish-brown silty clay loam about 8 inches thick. The upper part of the subsoil is brown friable silty clay loam about 3 inches thick, and the lower part is yellowish-red firm silty clay about 13 inches thick. Below this is weathered varicolored firm silty clay about 4 inches thick. The underlying clayey shale is mainly reddish brown and light gray.

Permeability is very slow. Natural fertility is medium to low. The underlying shale makes the available water capacity low.

These soils are used about equally for hay, range, and crops.

Representative profile of Edalgo silty clay loam, 3 to 7 percent slopes, eroded, 50 feet east and 150 feet south of northwest corner of northeast quarter of sec. 23, T. 1 N., R. 4 E.

A—0 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B1—8 to 11 inches, brown (10YR 5/3) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B2t—11 to 24 inches, yellowish-red (5YR 5/6) silty clay, yellowish red (5YR 4/6) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; very hard, firm; neutral; clear, smooth boundary.

C1—24 to 28 inches, light reddish-brown (5Y 6/4) and light-brown (7.5YR 6/4) silty clay, 80 percent dark red (2.5YR 3/6) and 20 percent yellowish red (5YR 5/6) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; very hard, firm; slightly acid; gradual, wavy boundary.

C2—28 to 60 inches, reddish-brown (10YR 5/4) and light-gray (2.5Y 7/2) weathered clayey shale, 40 percent dusky red (10YR 3/4) and 60 percent light gray (5Y 6/1) moist; massive; extremely hard, very firm; mildly alkaline.

These soils typically are not stony, but scattered pebbles and cobblestones of ironstone and sandstone occur in some places. Depth to shale ranges from 20 to 40 inches. These soils generally are noncalcareous, but in some places lime concretions occur just above the weathered clayey shale.

Edalgo soils are associated with the less clayey Lancaster and Hedville soils, which are underlain by sandstone.

Figure 7.—**Profile of Edalgo silty clay loam, 7 to 11 percent slopes. This is a moderately deep soil that formed in material weathered from shale. The scale is marked in feet and inches.**

Edalgo silty clay loam, 3 to 7 percent slopes, eroded (EdB2).—This soil is on the narrow, irregularly shaped ridgetops between deeply entrenched intermittent drainageways. It has the profile described as representative of the Edalgo series. In some places the surface layer is only 5 inches thick. In some areas the depth to the underlying sandstone and shale is quite variable within short distances. As much as 20 percent of some mapped areas consists of Lancaster soils.

Natural fertility is low, and organic-matter content is moderately low. Runoff is moderate. This soil absorbs water slowly. Root penetration is limited, and water movement is slow in the clayey subsoil. The underlying material severely limits root penetration and restricts water movement.

Most areas are cultivated, but some are in native grasses and are used as range. Reducing runoff, conserving mois-

ture, controlling erosion, and improving fertility and organic-matter content are the main management needs. Grain sorghum, wheat, and corn are the principal crops.

The only supply of irrigation water is from ponds. Water management and low fertility are concerns in irrigated areas. The size and shape of some areas make them better suited to native grass than to other uses. Proper range management is needed. Capability units IIIe-2 dryland and IIIe-21 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Edalgo silty clay loam, 7 to 11 percent slopes (EdC).—This soil is on ridgetops above steeper intermittent drainageways. Areas are small and generally widely scattered. This soil has a profile similar to that described as representative of the series, but the surface layer and subsoil are thinner. Outcroppings of the underlying shale or sandstone are common. About 25 percent of some areas consists of Lancaster soils.

Runoff is rapid. The soil is highly susceptible to water erosion in cultivated areas. Natural fertility is medium, and organic-matter content is moderate.

This soil is better suited to native grass and to use as range or hayland than to other uses. Keeping grass vigorous, controlling grazing, and reducing runoff are the main concerns in range management. Conserving moisture, reducing runoff, controlling erosion, and improving fertility are management needs in cultivated areas. Capability unit IVe-2 dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Geary Series

The Geary series consists of moderately sloping to steep, deep, silty and loamy, well-drained soils on uplands. These soils formed in moderately thick deposits of reddish-yellow, moderately fine textured loess of the Loveland Formation.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 11 inches thick. The upper part of the subsoil is about 4 inches of dark-brown, friable silty clay loam; the middle 20 inches is reddish-brown, firm silty clay loam; and the lower part is 7 inches of reddish-brown, generally noncalcareous loess of silty clay loam texture. The underlying material is reddish-yellow silty clay loam, but is less compact than the subsoil and has iron stains.

Available water capacity is high. Permeability is moderately slow. Natural fertility ranges from medium to low, and organic-matter content ranges from low to moderate.

The less sloping soils are well suited to cultivated crops. The steeper soils are in native grass and are used as range.

Representative profile of Geary silty clay loam, 7 to 11 percent slopes, under native grass, 1,056 feet west and 50 feet north of the southeast corner of sec. 31, T. 2 N., R. 1 E.

A—0 to 11 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B1—11 to 15 inches, dark-brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B21t—15 to 28 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3.5/3) moist; moderate, coarse, subangular blocky structure parting to medium to fine, subangular blocky structure; films on ped faces; firm; neutral; clear, smooth boundary.

B22t—28 to 35 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; films on ped faces; hard, firm; neutral; clear, smooth boundary.

B3—35 to 42 inches, reddish-brown (5YR 5/4) silty clay loam, yellowish red (5YR 4/6) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; hard, firm; neutral; clear, smooth boundary.

C1—42 to 54 inches, reddish-yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; hard, firm; iron stains; slight effervescence; lime concretions; mildly alkaline; gradual, smooth boundary.

C2—54 to 60 inches, reddish-yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; hard, firm; strong effervescence; moderately alkaline.

The A horizon in cultivated areas ranges from 4 to 12 inches in thickness. Some of the steep soils that formed entirely in reddish-yellow loess are immature and have a thinner A horizon and B horizon than the other Geary soils. The underlying material is dominantly silty clay loam, but in places it ranges from silty clay loam to sandy clay loam. Some profiles have lime concretions below a depth of 40 inches.

The severely eroded Geary soil in mapping units GJC3 and GeC3 is thinner and lighter colored than is defined as the range for the series. These differences do not alter the usefulness or behavior of the soil.

Geary soils are associated with Hastings, Morrill, and Jansen soils. They are at lower elevations than Hastings soils and their parent loess material is redder. They formed in loess, whereas Morrill soils formed in reworked glacial till that contained small stones and boulders. They differ from Jansen soils in not having underlying material of mixed coarse sand and gravel.

Geary silty clay loam, 3 to 7 percent slopes (GeB).—This soil is on the tops and short sides of ridges along upland drainageways.

Natural fertility is high, and the organic-matter content is moderate. Runoff is medium.

This soil is suited to cultivated crops, but most of the acreage is in native grasses. A vigorous stand of grass and controlled grazing are essential in areas used as range. Conserving water, reducing erosion, and maintaining fertility are the main management needs in cultivated areas. Grain sorghum, wheat, corn, and alfalfa are suitable crops. Capability units IIIe-1 dryland and IIIe-1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Geary silty clay loam, 3 to 7 percent slopes, eroded (GeB2).—This soil is on the tops and short sides of ridges along upland drainageways. It has a profile similar to the one described as representative of the series, but in most places the surface layer is lighter colored and is only about 7 inches thick. Some areas are severely eroded.

Runoff is medium. Organic-matter content is moderately low, and natural fertility is medium.

Most of the acreage is cultivated. This soil is suited to most of the dryland crops commonly grown in the county. Controlling runoff, reducing the hazard of erosion, and increasing fertility are the management needs in culti-

vated areas. Irrigation requires careful management. Capability units IIIe-1 dryland and IIIe-1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Geary silty clay loam, 7 to 11 percent slopes (GeC).—This soil is on hillsides and along upland drainageways. It has the profile described as representative of the series. In cultivated fields the surface layer is slightly lighter colored and thinner than it is in areas used as range.

This soil is medium in fertility and moderate in organic-matter content. Runoff is medium to rapid, depending on the amount of vegetation.

Most of the acreage is used as range or for hay, but some is cropland. Proper range use and conservation of moisture are management needs. This soil is suited to close-growing crops and to row crops. Conserving moisture, reducing runoff, and controlling erosion are the main management concerns in cultivated areas. Capability unit IVe-1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary silty clay loam, 3 to 11 percent slopes, severely eroded (GeC3).—This soil is on short slopes at the upper end of drainageways and on hillsides between upland drainageways. It has a profile similar to the one described as representative of the series, but the surface layer is thinner and lighter colored. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. Included in mapping are small areas of severely eroded Hastings soils.

This Geary soil is low in natural fertility and low in organic-matter content. The surface layer is moderately friable. The slope and the compactness of the soil make runoff rapid. In the many rills and crossable gullies, the reddish-brown subsoil and the substratum are exposed.

Most of the acreage is cultivated, but some areas are seeded to native grass. Wheat, alfalfa, corn, and grain sorghum are the most commonly grown crops. Conserving moisture, reducing runoff, controlling erosion, improving organic-matter content, and maintaining fertility are management needs in cultivated areas. Proper range use and a vigorous stand of grass are essential in areas seeded to native grass. Capability unit IVe-8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary silty clay loam, 11 to 30 percent slopes (GeE).—This soil is in narrow areas along upland drainageways and on hillsides. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are thinner. The surface layer is dark-brown to dark reddish-brown silty clay loam, about 7 inches thick in the uneroded areas. Some areas are cultivated or were formerly cultivated. In these the darker surface layer has been completely removed by water erosion. The underlying loess is exposed in some of the steeper areas. Slopes are not smooth, but have a catstep appearance. Slopes range up to 45 percent in gradient, but most commonly are about 25 percent.

As much as 20 percent of some mapped areas consists of Hastings soils that formed in yellowish-brown loess. These areas are on the upper part of strong slopes along drainageways. Sand and gravel crops out in small areas on the lower part of steep slopes. Small, narrow strips of a Hobbs soil that formed in colluvium and alluvium are on the bottoms of drainageways. Runoff is rapid to very rapid depending on the amount of vegetation. The organic-matter content is moderately low.

Most of the acreage is in native grass and is used as range. Keeping grass vigorous, reducing runoff, conserving moisture, and controlling grazing are the principal management needs. Native trees and small shrubs are on the steep slopes near the lower ends of drainageways. Capability unit VIe-1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary and Jansen soils, 5 to 11 percent slopes (GJC).—These soils are on the sides and tops of ridges along the valleys of the Little Blue River and Big Sandy Creek and their tributaries. Some areas are entirely Geary soil, other areas are entirely Jansen soil, and many areas contain both. The surface layer ranges from silty clay loam to sandy loam. The Geary soil is deeper over the underlying mixed sand and gravel than the Jansen soil. Included with these soils in mapping are small areas of Meadin soils.

The available water capacity is moderate to low. Natural fertility is medium to low. The deeper Geary soils have the higher available water capacity and the medium fertility. Runoff is medium to rapid, depending on the amount of vegetation. Organic-matter content is moderately low to moderate.

Conserving water, protecting the soils against water erosion, and maintaining fertility are the main management needs in cultivated areas. Most of the acreage is in native grass and is used as range. Capability unit IVe-1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary and Jansen soils, 5 to 11 percent slopes, eroded (GJC2).—These soils are on sides and tops of ridges along the valleys of the Little Blue River and Big Sandy Creek and their tributaries. They generally are nearly equal in proportion, but some areas are mainly Geary soil and other areas are mainly Jansen soil. Their surface layer is lighter colored than that of uneroded Geary and Jansen soils that have similar slopes, and it ranges from silty clay loam to sandy loam.

These soils are medium to low in natural fertility and low to moderately low in organic-matter content. The available water capacity ranges from high in the deeper soils to low in the shallower soils. Runoff is medium to rapid.

Most of the acreage is cultivated. Wheat and grain sorghum are the crops most commonly grown. Reducing runoff, conserving moisture, controlling erosion, maintaining fertility, and returning crop residue to the soil are management needs. Capability unit IVe-1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary and Jansen soils, 5 to 11 percent slopes, severely eroded (GJC3).—These soils are along the valleys of the Little Blue River and Big Sandy Creek and their tributaries. The profiles of these soils are similar to the ones described as representative of their respective series, but erosion has removed nearly all of the darkened surface layer and part of the subsoil. The surface layer ranges from silty clay loam to sandy loam. There are

some rills and small gullies. As much as 5 to 10 percent of the mapped area is Meadin soil.

These Geary and Jansen soils are more droughty than similar uneroded soils. Natural fertility and organic-matter content are low. Available water capacity is high to low. Runoff is rapid.

Most of the acreage is cultivated. Grain sorghum and wheat are the crops most commonly grown. Conserving moisture, reducing runoff, controlling erosion, and maintaining fertility are the main management needs. These soils are suited to native grasses but need a high level of management in establishing and maintaining the grasses. Capability unit IVe–8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Geary and Jansen soils, 11 to 30 percent slopes (GJE).—These soils are on sides of intermittent upland drainageways leading into the valleys of the little Blue River and Big Sandy Creek. They generally are nearly equal in proportion, but some areas are mainly Geary soil and other areas are mainly Jansen soils. The surface layer ranges from silty clay loam to sandy loam. The underlying gravel is exposed in some areas. As much as 25 percent of that mapped area is Meadin soil.

Organic-matter content is moderately low. Available water capacity is generally low, but the deeper Geary soil has a high available water capacity. Natural fertility is medium to low. Runoff is rapid.

These soils are not suitable for cultivation. Most of the acreage is in native grasses and is used as range. The Geary soils support a fair to good cover of mid and tall native grasses. The Jansen and the Meadin soils are more droughty and have sparse vegetative cover.

Keeping grass vigorous, reducing runoff, and controlling grazing are the main management needs. Capability unit VIe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Gravel Pits

Gravel pits (GP) are mainly on the bottom lands, upland ridges, and draws bordering the Little Blue River, Big Sandy Creek, and Little Sandy Creek. They are mainly deep excavations from which sand and gravel have been removed. They are generally filled with water, except when the bottom of the pit is above the natural water table. Numerous piles of sand are adjacent to the pits. Gravel pits are not suited to crops, grazing or trees. They are suited to wildlife habitat and recreation, and some pits are stocked with fish. Capability unit VIIIs–1 dryland; not assigned to a range site or to a windbreak suitability group.

Hastings Series

The Hastings series consist of deep, gently sloping to strongly sloping, well-drained soils on uplands (fig. 8). These soils formed in silty loess.

In a representative profile the surface layer is dark-gray silt loam about 10 inches thick. The upper part of the subsoil is about 4 inches of dark grayish-brown, friable light silty clay loam, and the lower part is about 24 inches of grayish-brown, friable silty clay loam. The upper part of the underlying material is light yellowish-brown silt loam about 10 inches thick. Below this is very pale brown silt loam that contains an abundance of lime. It is friable and easily penetrated by roots.

Permeability is moderately slow, and available water capacity is high. Natural fertility is medium to high.

Hastings soils are suitable for cultivation. Most areas are used for crops. The nearly level and gentle slopes are well suited to irrigation.

Representative profile of Hastings silt loam, 3 to 7 percent slopes, under native grass, 528 feet west and 150 feet north of southeast corner of sec. 21, T. 2 N., R. 1 E.

A—0 to 10 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) *moist*; moderate, medium, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, very friable; slightly acid; clear, smooth boundary.

B1—10 to 14 inches, dark grayish-brown (10YR 4/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; hard, friable; neutral; clear, smooth boundary.

B2t—14 to 30 inches, grayish-brown (10YR 5/2) silty clay loam, dark brown (10YR 4/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; films on ped faces; hard, friable; neutral; clear, smooth boundary.

Figure 8.—**Profile of Hastings silt loam showing a friable silty clay loam subsoil that has moderately slow permeability. The scale is marked in feet and inches.**

B3—30 to 38 inches, grayish-brown (10YR 5/2) silty clay loam, dark brown (10YR 4/3) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; hard, friable; neutral; clear, smooth boundary.

C1—38 to 48 inches, light yellowish-brown (10YR 6/4) heavy silt loam, dark brown (10YR 5/3) moist; moderate, coarse, prismatic structure parting to weak, medium, subangular blocky structure; slightly hard, friable; slight effervescence; neutral; clear, smooth boundary.

C2—48 to 60 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; few mottles; massive; slightly hard, friable; strong effervescence; moderately alkaline.

Variations in Hastings soils result mainly from differences in the degree of erosion. The A horizon in eroded areas is brown or pale-brown silty clay loam 3 to 8 inches thick. Depth to lime generally ranges from 36 to 48 inches but may be less in the more sloping soils.

The Hastings soil in mapping unit HtC3 has a lighter colored surface layer than is defined as the range for the series. This difference does not alter the usefulness or behavior of the soil.

Hastings soils are associated with Crete and Geary soils. They have a less clayey and more permeable B2t horizon than Crete soils. They are at higher elevations and have finer textured B2t horizon than Geary soils, which formed in more reddish loess.

Hastings silt loam, 1 to 3 percent slopes (HsA).—This soil is on broad ridges. Crete soils make up 10 to 15 percent of some mapped areas.

Runoff is medium, and the hazard of erosion is slight to moderate. Organic-matter content is moderate, and tilth is easily maintained. Natural fertility is high.

Most of the acreage is cultivated. Conserving moisture and reducing runoff are the main management needs. Wheat, grain sorghum, corn, and alfalfa are the principal dryland crops. Grain sorghum and corn are the principal irrigated crops. Managing water and maintaining fertility are the special concerns in irrigated areas. Capability units IIe–1 dryland and IIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Hastings silt loam, 3 to 7 percent slopes (HsB).—This soil is on ridgetops and short sides of drainageways in the uplands. It has the profile described as representative of the series. Included in mapping are small areas of eroded soils that have a silty clay loam surface layer.

Runoff is medium. Natural fertility is high, and organic-matter content is moderate.

This soil is suitable for cultivated crops, but most of the acreage is in native grasses. Controlling grazing is the main management need in areas used as range. Grain sorghum, wheat, alfalfa, and corn are the principal cultivated crops. Conserving moisture and reducing runoff are the main management needs in cultivated areas. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Hastings silt loam, 7 to 11 percent slopes (HsC).—This soil is at the higher elevations on hillsides. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are thinner. Depth to lime ranges from 28 to 38 inches. Included in mapping are areas of Geary soils that make up as much as 20 percent of the acreage on the lower part of slopes.

Runoff is medium to rapid, depending on the amount of vegetative cover. Natural fertility is medium, and organic-matter content is moderate.

Most of the acreage is in native grasses. Keeping grass vigorous and controlling grazing are the main management needs in areas used as range. Wheat and alfalfa are the principal cultivated crops. Reducing runoff, reducing the hazard of erosion, and conserving moisture are management needs in cultivated areas. Capability unit IVe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Hastings silty clay loam, 3 to 7 percent slopes, eroded (HtB2).—This soil is mainly on ridgetops and on sides of drainageways in the uplands. It has a profile similar to the one described as representative of the series, but the surface layer is dark grayish-brown silty clay loam about 5 inches thick, and it has a thinner subsoil. In places erosion has exposed the lighter colored lower part of the subsoil. As much as 10 percent of the mapped area is Geary soils.

The fine texture of the surface layer makes workability poor. Runoff is rapid. Organic-matter content is low.

This soil is fairly well suited to cultivated crops. Most of the acreage is cultivated. Grain sorghum and wheat are the principal crops, but corn and alfalfa also are grown. Conserving moisture, reducing runoff, and reducing the hazard of erosion are the main management needs in dryland areas. Some areas are irrigated. Water management is needed in irrigated areas. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Hastings silty clay loam, 3 to 11 percent slopes, severely eroded (HtC3).—This soil is at the upper end of drainageways and on hillsides between drainageways in the uplands. It has a profile similar to that described as representative of the series, but erosion has removed most of the original surface layer and, in places, part of the subsoil, and the present surface layer is light-colored silty clay loam. Rills and small crossable gullies are numerous. Included in mapping are areas of eroded Geary soils at the lower elevations.

The compactness and the moderate to low organic-matter content of the soil make runoff rapid. The surface layer has poor workability and tilth.

Most of the acreage is cultivated. Grain sorghum and alfalfa are the crops most commonly grown. Conserving moisture, controlling runoff, and reducing the hazard of erosion are the main management needs. Capability unit IVe–8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Hedville Series

The Hedville series consists of shallow, somewhat excessively drained soils that formed in material weathered from interbedded sandstone and sandy shale (fig. 9). Slopes are moderate to steep. Sandstone outcrops are numerous on uplands.

In a representative profile the surface layer consists of dark-gray loam and brown sandy loam about 14 inches thick. Small and medium fragments of sandstone are numerous. The underlying bedrock is medium-soft to hard reddish-brown sandstone interbedded with dark-gray sandy shale.

Figure 9.—**Profile of Hedville loam showing broken, stonylike underlying material. The scale is marked in feet.**

Permeability is moderate above the bedrock. Natural fertility is medium to low. Available water capacity is low.

Nearly all the acreage is permanent range. Steep slopes and shallowness make these soils unsuitable for cultivation. Scattered oak trees grow on the steep banks along drainageways.

Representative profile of Hedville loam, 7 to 30 percent slopes. under native grasses, 528 feet south and 300 feet west of the northeast corner of sec. 13, T. 1 N., R. 2 E.

A11—0 to 8 inches, dark-gray (10YR 4/1) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; loose, very friable; many angular cobbly sandstone fragments; slightly acid; clear, smooth boundary.

A12—8 to 14 inches, brown (7.5YR 4/2) sandy loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; many pebbles and cobblestones of weathered sandstone; clear, gradual boundary.

R—14 to 30 inches, reddish-brown (5YR 4/4) weathered sandstone and interbedded sandy shale.

Depth to sandstone or shale bedrock ranges from 8 to 20 inches. The soils are stony, but the content of coarse fragments does not exceed 20 percent of the soil volume. Outcrops of consolidated sandstone are common along steep ledges.

Hedville soils are associated with Lancaster and Edalgo soils. They are steeper and more shallow than the Lancaster soils. They are coarser textured and more shallow than the Edalgo soils.

Hedville loam, 7 to 30 percent slopes (HvE).—This soil is in irregularly shaped areas on sides and tops of ridges between the intermittent drainageways and valley sides along the downstream part of Little Blue River. Slopes range up to 45 percent, but most commonly are about 25 percent. As much as 25 percent of some mapped areas is small, irregularly shaped areas of moderately deep Lancaster soil.

This Hedville soil is droughty because it has a low available water capacity. Runoff is rapid. Organic-matter content is low. The underlying material limits root penetration and restricts water movement.

Most areas of this soil are in native grasses and are used as range. Maintaining a vigorous stand of grasses is the main management need. Grass cover is needed to reduce runoff and conserve moisture. Capability unit VIs-4 dryland; Shallow Sandy range site; Shallow windbreak suitability group.

Hobbs Series

The Hobbs series consists of deep, nearly level and gently sloping, well-drained soils that formed mainly in noncalcareous, medium-textured sediments. These soils are on narrow bottom lands along intermittent drainageways and on wide bottom lands and foot slopes in the valleys of perennial streams.

In a representative profile the upper 26 inches is the surface layer of dark-gray silt loam. Below this is gray, very friable silt loam about 14 inches thick that is lighter in color with increasing depth. The underlying material is grayish-brown silt loam.

These soils absorb water readily. Permeability is moderate. Natural fertility is high. Available water capacity is high. Most areas do not have a permanent water table within a depth of 10 feet. Areas nearest the drainageways are occasionally flooded for short periods after heavy rainstorms. Areas on the high bottom lands along perennial streams and on foot slopes are seldom flooded.

Most of the acreage is cultivated. The Hobbs soils at higher elevations on bottom lands are well suited to irrigation.

Representative profile of Hobbs silt loam, 0 to 1 percent slopes, in a cultivated field, 100 feet south and 50 feet west of the northeast corner of southeast quarter of sec. 2, T. 3 N., R. 3 E.

Ap—0 to 5 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, very friable; slightly acid; abrupt, smooth boundary.

A12—5 to 26 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, very friable; slightly acid; gradual, smooth boundary.

AC—26 to 40 inches, gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak, moderate, subangular blocky structure parting to weak, fine, subangular blocky structure; soft, very friable; slightly acid; gradual, smooth boundary.

C—40 to 60 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; few brownish mottles; weak coarse, subangular blocky structure parting to weak, fine, subangular blocky structure; soft, very friable; neutral.

Variations in the profile generally are uncommon, but buried, darkened layers are in some places. The frequency of flooding depends on the elevation above the stream channel.

Hobbs soils are associated with Cass and Hord soils. They have a more silty and darker colored C horizon than Cass soils. They are more stratified and are at lower elevations along the streams than Hord soils and lack the B horizon that is typical of those soils.

Hobbs silt loam, 0 to 1 percent slopes (Hb).—This well-drained soil is on high bottom lands in the valleys of perennial streams. It has the profile described as representative of the series. Included in mapping are small areas of Hobbs silt loam, occasionally flooded.

This Hobbs soil is seldom flooded, except for short periods after rapid snowmelt or after extremely heavy rain. The surface layer is friable, has a moderate amount of organic matter, and is easily tilled. Runoff is slow to medium. The subsoil is slightly more compact than the surface layer and has moderate permeability.

Most of the acreage is cultivated. Grain sorghum, corn, wheat, and alfalfa are commonly grown. Maintaining high fertility and good tilth are the main management needs. This soil is well suited to irrigation, and grain sorghum and corn are the principal irrigated crops. Proper water management is needed in irrigated areas. Capability units I–1 dryland and I–1 irrigated; Silty Lowland range site; Silty to Clayey windbreak suitability group.

Hobbs silt loam, occasionally flooded (0 to 1 percent slopes) (2Hb).—This soil formed in silty alluvium on low bottom lands along tributaries of main drainageways. It is occasionally flooded following heavy rains. It has a profile similar to the one described as representative of the series, but it contains strata of coarser material.

Runoff is slow to medium. Flooding seldom causes a total crop loss, but at times it delays tillage or necessitates reseeding of newly planted crops. Organic-matter content is moderate, and the surface layer is friable and easily tilled.

Most of the acreage is cultivated. Grain sorghum, corn, and alfalfa are the most common crops. The hazard of flooding in spring limits the use of this soil for wheat. This soil is suited to irrigation, but the hazard of flooding and the irregular distribution of soil areas limit the acreage that is irrigated. Grain sorghum and corn are the principal irrigated crops. Small areas adjacent to the major streams or drainage channels have a dense cover of trees and tame grasses. These areas are used for limited grazing. Capability units IIw–3 dryland and I–2 irrigated; Silty Overflow range site; Moderately Wet windbreak suitability group.

Hobbs silt loam, 1 to 3 percent slopes (HbA).—This soil is in scattered areas along the valley foot slopes and adjacent to small bottom-land drainageways.

This soil is moderate in organic-matter content and has good tilth. It absorbs water readily and has a high available water capacity. Runoff is medium. Flooding from sloping soils immediately above this soil is a major hazard.

Most of the acreage is cultivated. This soil is suited to all commonly grown crops. Controlling runoff from adjacent land is the main management need. Some areas are irrigated. Water management is the principal need in irrigated areas. Capability units IIe–1 dryland and IIe–1 irrigated; Silty Lowland range site; Silty to Clayey windbreak suitability group.

Hord Series

The Hord series consists of deep, well-drained soils that formed in silty alluvium. These soils are on benches and sides of drainageways adjacent to major streams. They are nearly level to gently sloping.

In a representative profile the upper 5 inches of surface layer consists of grayish-brown silt loam, and the lower 11 inches consists of gray silt loam. The underlying material is pale-brown silt loam in the upper 14 inches and is grayish-brown silt loam to a depth of 5 feet or more.

These soils absorb water readily. Available water capacity is high, and permeability is moderate. Natural fertility is high.

Most of the acreage is cultivated. These soils are well suited to irrigation.

Representative profile of Hord silt loam, 0 to 1 percent slopes, in a cultivated field, 0.35 mile east and 0.25 mile south of the northwest corner of sec. 5, T. 1 N., R. 3 E. (south of railroad).

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure parting to weak, fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A12—5 to 16 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to weak, fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

B1—16 to 24 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky structure; soft, very friable; neutral; clear, smooth boundary.

B2—24 to 38 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

C1—38 to 52 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

C2—52 to 60 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; slightly hard, friable; neutral.

Wide variations in the profile are uncommon, but buried soils are present in some places. In some places along the breaks between benches and bottom lands, the soil is coarser textured throughout the profile. Free lime generally is below a depth of 4 feet. In places the alluvium is stratified with darker and lighter colored silt loam.

Hord soils are associated with the Hobbs soils. They have more distinct horizons than the Hobbs soils, and they are less stratified.

Hord silt loam, 0 to 1 percent slopes (Hd).—This soil formed in silty alluvium on benches. It has the profile described as representative of the series. Included in mapping are a few areas of soils that have a silty clay loam subsoil and areas where seepage has increased the alkalinity of the soil.

Runoff is slow. Organic-matter content is moderate, and the soil is easily tilled.

Most of the acreage is cultivated. This soil is suited to all of the crops grown in the county. Maintaining a high level of management is the principal management concern. This soil is well suited to irrigation. Corn and grain sorghum are the principal irrigated crops. Managing water and maintaining fertility are the main management needs in irrigated areas. Capability units I–1 dryland and I–1 irrigated; Silty Lowland range site; Silty to Clayey windbreak suitability group.

Hord silt loam, 1 to 3 percent slopes (HdA).—This soil is on sides of shallow, intermittent drainageways on terraces and on the sides of ridges near the loess uplands. It has a profile similar to the one described as representative for the series, but in some places accumulations of colluvium and alluvium have made the surface layer thicker.

Natural fertility is high. Organic-matter content is moderate, and the soil is easily tilled. Runoff is medium.

Most of the acreage is cultivated. This soil is suited to all crops common to the county. Reducing runoff and conserving moisture are the main management needs. This soil is suited to irrigation, but size and shape of soil areas limit the acreage that can be irrigated. Corn and grain sorghum are the principal irrigated crops. Capability units IIe–1 dryland and IIe–1 irrigated; Silty Lowland range site; Silty to Clayey windbreak suitability group.

Jansen Series

The Jansen series consists of moderately deep, moderately sloping to strongly sloping, well-drained soils (fig. 10) that formed mainly in loamy material overlying sand and gravel. These soils are on uplands, along upland breaks on both sides of the Little Blue River and Big Sandy Creek.

In a representative profile the surface layer is grayish-brown loam about 10 inches thick. The next layer is dark grayish-brown light clay loam about 3 inches thick. The subsoil is friable, brown sandy clay loam about 19 inches thick. The underlying material is stratified sand, coarse sand, and gravel at a depth of 32 inches. The upper part is darker than the lower part.

These soils are somewhat droughty and erode easily. Permeability is moderate in the solum and very rapid in the underlying sand and gravel. Available water capacity is moderate. Natural fertility is medium to low. Root penetration is mainly restricted to the underlying sand and gravel.

Only about half the acreage is used for cultivated crops. The rest is in native grasses and is used as range. Irrigation is not practical, except on the gentle slopes.

Representative profile of Jansen loam, 3 to 7 percent slopes, under native grass, 528 feet west and 25 feet north of the southeast corner of sec. 26, T. 2 N., R. 2 E.

A11—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; soft, very friable; slightly acid; clear, smooth boundary.

A12—10 to 13 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B21t—13 to 24 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4.4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B22t—24 to 32 inches, brown (7.5YR 5/4) sandy clay loam, slightly increased in coarse gravel, dark brown (7.5YR 4/4) moist; weak, coarse, subangular blocky structure

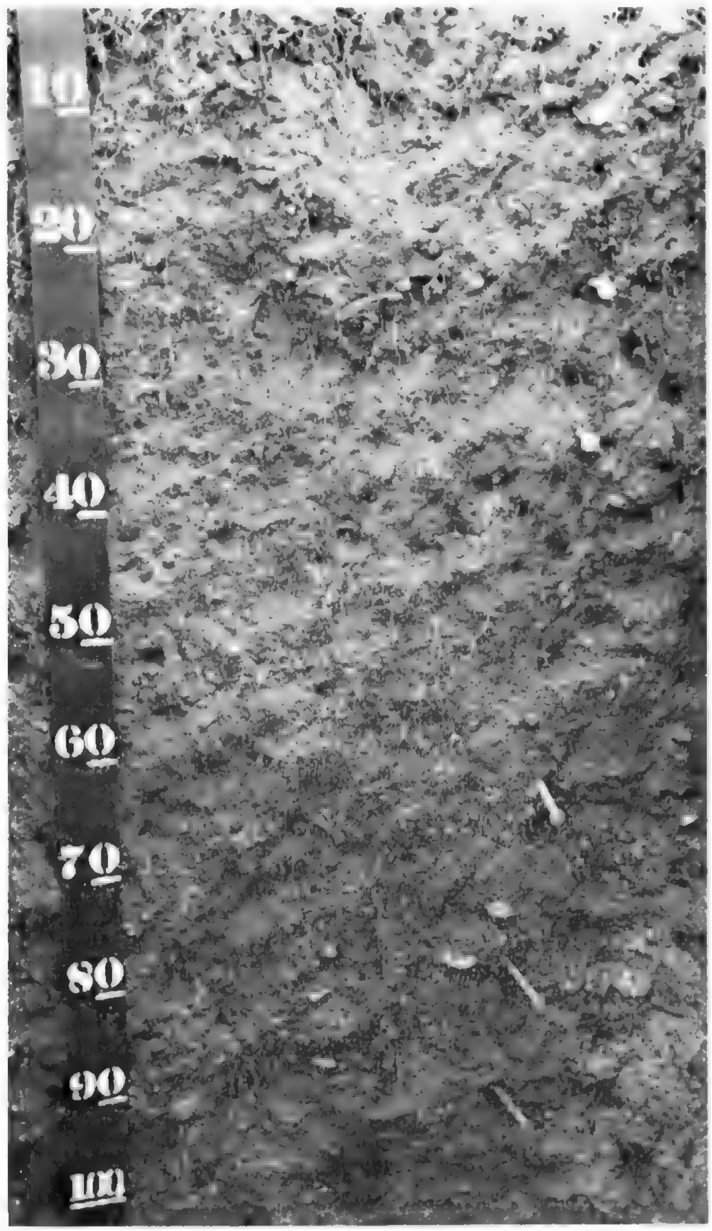


Figure 10.—**Profile of Jansen loam. This is a moderately deep soil underlain by stratified coarse sand and gravel. The scale is marked in centimeters.**

parting to moderate, medium, subangular blocky structure; slightly hard, friable; slightly acid; gradual, smooth boundary.

IIC1—32 to 40 inches, brown (10YR 5/3) gravel and coarse sand, dark brown (10YR 4/3) moist; single grained; loose; neutral; gradual, wavy boundary.

IIC2—40 to 60 inches, very pale brown (10YR 7/3) sand and gravel, pale brown (10YR 6/3) moist; single grained; loose; neutral.

The surface layer ranges from silt loam to sandy loam. The surface layer and subsoil are 1 to 5 percent coarse sand and gravel. The subsoil is sandy clay loam that grades to silty clay loam with increasing depth. Depth to the underlying coarse-textured sand and gravel averages about 28 inches but ranges from 20 to 40 inches.

The Jansen soil in mapping unit GJC3 is lighter colored than is defined as the range for the series, but this difference does not alter the usefulness or behavior of the soil.

Jansen soils are associated with Geary, Morrill, and Meadin soils. They are not so deep as Geary and Morrill soils. They are deeper over sand and gravel than Meadin soils.

Jansen loam, 3 to 7 percent slopes (JaB).—This soil is on low ridges and sides of intermittent drainageways adjacent to the Little Blue River and Big Sandy Creek. It has the profile described as representative for the series. Included in mapping are small areas of shallow Meadin soils.

Runoff is medium. Natural fertility is medium to low, and organic-matter content is moderately low.

Most of the acreage is in native grasses and is used as range. This soil is suitable for cultivation. Grain sorghum and wheat are the main crops. Conserving moisture, controlling erosion, and maintaining a high level of fertility are management needs. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Jansen loam, 3 to 7 percent slopes, eroded (JaB2).—This soil is on low ridges and sides of intermittent drainageways adjacent to the Little Blue River and Big Sandy Creek. It has a profile similar to the one described as representative of the series, but it has a moderately eroded surface layer, about 7 inches thick, that is generally lighter colored. As much as 20 percent of some mapped areas is Meadin soils.

Natural fertility and the organic-matter content are low. Runoff is medium.

Most of the acreage is cultivated. Wheat and grain sorghum are the crops most commonly grown. Alfalfa is not well suited, because the underlying material is gravelly. Conserving moisture, controlling runoff, and reducing the hazard of erosion are the main management needs. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Jansen loam, 7 to 11 percent slopes (JaC).—This soil is on sides of drainageways. It has a profile similar to the one described as representative of the series, but generally this soil is only about 24 inches deep over the coarse sand and gravel. In some areas the surface layer is moderately eroded and is only about 7 inches thick. As much as 20 percent of some mapped areas is Meadin soils.

This Jansen soil is more droughty than similar soils underlain by loamy material. Runoff is medium or rapid, depending on the amount of vegetation.

Most of the acreage is in native grasses and is used as range. Keeping a vigorous stand of grasses, conserving moisture, controlling erosion, and maintaining fertility are the main management needs. Small grain is the main crop, and grain sorghum is grown occasionally. Capability unit IVe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Kipson Series

The Kipson series consists of strongly sloping and steep, shallow, somewhat excessively drained soils on uplands. These soils formed in material weathered from interbedded limestone and limy shale. A thin layer of loess overlies the limestone in most places.

In a representative profile the surface layer is gray silt loam about 7 inches thick. The next layer is light brownish-gray friable silt loam about 8 inches thick that has numerous small and medium fragments of limestone. The underlying material is weathered, soft limestone and limy shale that is sufficiently fragmented to permit root penetration.

Internal drainage is restricted by the underlying limestone and shale. Permeability is moderate above the underlying material. Natural fertility is medium, and available water capacity is low.

Kipson soils are too steep and too shallow for cultivated crops. Nearly all the acreage is used as permanent range or for hay.

Representative profile of Kipson silt loam, 7 to 30 percent slopes, under native grasses, 1,056 feet west and 50 feet north of the southeast corner of sec. 22, T. 1 N., R. 2 E.

A—0 to 7 inches, gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; strong effervescence mainly because of the limestone fragments; moderately alkaline; clear, smooth boundary.

C1—7 to 15 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; strong effervescence mainly because of the underlying limestone; numerous limestone fragments; moderately alkaline; gradual, wavy boundary.

C2—15 to 36 inches, white (10YR 8/2) limestone and limy shale, very pale brown (10YR 7/3) moist; violent effervescence.

The A horizon ranges from 1 inch to 3 inches in thickness and is silt loam or silty clay loam. Depth to the underlying material ranges from 7 to 20 inches and varies greatly within short distances. The size and number of limestone fragments in the A horizon vary because fragments move downslope from high-lying areas. The unweathered limestone and limy shale are exposed in some places.

Kipson soils are associated with Benfield soils. They are steeper and shallower than Benfield soils and lack the B horizon that is typical of these soils.

Kipson silt loam, 7 to 30 percent slopes (KsD).—This soil is in irregularly shaped areas on sides of valleys south of the Little Blue River and in more uniform areas along intermittent drainageways south of Rose Creek. Included in mapping are areas of very shallow soils that formed in limestone and some areas of soils that contain limestone within a depth of less than 10 inches. These inclusions make up as much as 30 percent of some

mapped areas. Also included is an area of less sloping soils southwest of Thompson.

Runoff is rapid. The soil absorbs water readily, but shallowness causes the available water capacity to be low. Organic-matter content is moderately low. Limestone outcrops are more common on the steeper slopes than elsewhere. Root penetration is limited and water movement is restricted by the underlying material.

Most areas are in native grasses. They are used mostly as range, but some areas are used for native hay. Maintaining a vigorous stand of grasses is the main management need. Good cover reduces runoff nd conserves moisture. Capability unit VIs-4 dryland; Shallow Limy range site; Shallow windbreak suitability group.

Lancaster Series

The Lancaster series consists of moderate to steep, moderately deep, well-drained soils on uplands. These soils formed in weathered sandstone and shale.

In a representative profile the surface layer is dark grayish-brown loam about 10 inches thick. The subsoil is friable clay loam. The upper 8 inches is yellowish brown, and the lower 8 inches is brownish yellow. The underlying material is partly weathered sandstone and sandy shale that is reddish, grayish, and yellowish. Depth to the underlying material is about 26 inches.

Natural fertility is medium. Permeability is moderate and available water capacity is low.

These soils are mostly used as range and for hay. The moderately sloping soils are suitable for cultivation.

Representative profile of Lancaster loam, 3 to 7 percent slopes, eroded, 528 feet west and 50 feet south of the northeast corner of sec. 22, T. 1 N., R. 1 E.

A—0 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B2t—10 to 18 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B3—18 to 26 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky structure; hard, friable; slightly acid; gradual, wavy boundary.

R1—26 to 48 inches, 80 percent light-gray (2.5Y 7/2) and 20 percent reddish-yellow (7.5YR 6/8) sandy shale, light olive gray (5Y 6/2) and yellowish brown (10YR 5/8) moist; massive: very hard, very firm; neutral; gradual, irregular boundary.

R2—48 to 60 inches, thin reddish-yellow (5YR 6/8) layers of sandstone and shale, yellowish red (5YR 5/6) moist; variegation of reddish, grayish, and yellowish colors; massive; very hard, very firm.

Depth to sandstone and sandy shale ranges from 22 to 40 inches. Few to many, small, hard fragments of sandstone occur on the surface and throughout the soil in some places.

The Lancaster soil in mapping unit LanC3 is lighter colored than is defined as the range for the series, but this difference does not alter the usefulness or behavior of the soil.

Lancaster soils are associated with Benfield, Kipson, and Hedville soils. They are coarser textured than Benfield and Kipson soils and are underlain with weathered sandstone and sandy shale whereas Benfield and Kipson soils are underlain with limestone. They formed in sandstone and are deeper than Hedville soils.

Lancaster loam, 3 to 7 percent slopes, eroded (LcB2).—This soil is on ridgetops and on foot slopes between drainageways. It has the profile described as representative of the series. The surface layer is eroded and is 5 to 10 inches thick in most places. As much as 20 percent of some mapped areas is deep soils over sandstone and sandy shale.

Runoff is medium. Organic-matter content is moderate in areas of native grass and low in the cultivated fields. The underlying sandstone and shale limit root penetration and restrict water movement. Applications of plant nutrients are needed in cultivated areas.

Most areas are cultivated, but some are used for native hay and as range. Grain sorghum and wheat are the most commonly grown crops. Conserving moisture, controlling runoff, improving fertility, and reducing the hazard of erosion are the main management needs in cultivated areas. Keeping a vigorous stand of grass is necessary in areas used for native hay and as range. Some areas are suitable for irrigation, but generally sufficient quantities of water are not available from the underlying sandstone and shale. Capability units IIIe-1 dryland and IIIe-1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Lancaster loam, 7 to 11 percent slopes (LcC).—This soil is on sides of valleys above areas of steeper soils along the drainageways. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are slightly thinner. Areas are irregularly shaped and generally are less than 35 acres in size. Runoff is medium, and organic-matter content is moderate. This soil absorbs water readily but has low available water capacity because of the restrictive underlying material. The underlying material also limits root penetration and restricts water movement.

Most areas are used as range or for hay. Good management practices are needed to maintain a high production of native grass for forage. The suitability of this soil for cultivation is limited. Intensive conservation measures are needed. Capability unit IVe-1, dryland; Silty range site; Silty to Clayey windbreak suitability group.

Lancaster soils, 7 to 11 percent slopes, severely eroded (LanC3).—These soils are on sides of valleys. They have a profile similar to the one described as representative of the series, but erosion has removed most of the original surface layer, and the present surface layer is yellowish brown, sandier than the original, and contains many small fragments of sandstone. It ranges from loam to sandy clay loam. The depth to weathered sandstone and sandy shale is generally about 22 to 40 inches, but in some places it is less than 20 inches. A few rills and crossable gullies are on the hillsides.

These soils are low in organic-matter content and fertility. The underlying material limits root penetration and restricts water movement. Runoff is rapid.

Most of the acreage is cultivated. Grain sorghum and wheat are the principal crops grown. The soil is not well suited to alfalfa unless it has been limed. Controlling runoff and conserving moisture are management needs.

Capability unit IVe–8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Lancaster and Edalgo soils, 11 to 30 percent slopes (LEE).—These soils are mainly on the sides of intermittent drainageways south of Rose Creek and the tributaries on the north side of the Little Blue River between Endicott and Steele City. Some areas are entirely Lancaster soil, other areas are entirely Edalgo soil, and many consist of both. The surface layer ranges from loam to silty clay loam. Outcrops of sandstone on steep ledges are common. About 65 to 75 percent of this mapping unit is Lancaster soil, and 25 to 35 percent is Edalgo soil. Included with these soils in mapping are small areas of Hobbs soils in the bottoms of the drainageways.

The organic-matter content is moderately low to low, and natural fertility is medium to low. Available water capacity is generally low. Runoff is rapid.

These soils are not suited to cultivated crops. Most of the acreage is in native grasses and is used as range. The soils support a fair to good cover of mid and tall native grasses that helps to reduce runoff and conserve moisture. Keeping a vigorous stand of grass is the main management concern. Capability unit VIe–1 dryland; Lancaster soil in Silty range site, Edalgo soil in Clayey range site; both soils in Silty to Clayey windbreak suitability group.

Malcolm Series

The Malcolm series consists of deep, well-drained soils that formed in light brownish-gray silt. These soils are at the lower elevations on sides of intermittent drainageways in the uplands. They are exposed as small outcrops between the loess and till in dissected parts of the loess-mantled till plain.

In a representative profile the surface layer is dark-gray silt loam about 7 inches thick. The upper part of the subsoil is dark grayish-brown, friable silt loam about 7 inches thick, the middle part is grayish-brown, very friable silt loam about 9 inches thick, and the lower part is brown, very friable very fine sandy loam about 9 inches thick. The underlying material is dominantly light brownish-gray very fine sandy loam that has thin lenses and strata of sand or clay.

These soils absorb water readily. Available water capacity and permeability are moderate. Natural fertility is medium to low.

Most areas are used as range, but some are used for crops. The underlying material is a source of select subgrade material for highways.

Representative profile of Malcolm silt loam, 7 to 11 percent slopes eroded, 792 feet east and 50 feet south of the northwest corner of sec. 11, T. 3 N., R. 3 E.

A—0 to 7 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; gradual, smooth boundary.

B1—7 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to weak, medium, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B2—14 to 23 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky structure; soft, very friable; slightly acid; gradual, smooth boundary.

B3—23 to 32 inches, brown (10YR 5/3) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak, coarse, subangular blocky structure parting to weak, medium to fine, subangular blocky structure; loose, very friable; slightly acid; gradual, smooth boundary.

C—32 to 60 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam, light olive brown (2.5Y 5/4) moist; few, fine, reddish-brown (5YR 5/4) mottles; weak, coarse, subangular blocky structure parting to weak, medium to fine, subangular blocky structure; loose; very friable; slightly acid.

The soils are noncalcareous throughout and range from medium acid to slightly acid. They have a few to common, fine or medium, distinct, reddish-brown or strong-brown mottles in some places.

Malcolm soils are associated with Mayberry, Morrill, and Burchard soils and generally are below those soils on the landscape. They have a coarser textured solum than that of Mayberry and Morrill soils. They are less clayey than Burchard soils and do not have the lime zone in the lower part of the solum that is typical of those soils.

Malcolm silt loam, 7 to 11 percent slopes, eroded (MnC2).—This soil is in small, irregularly shaped areas at lower elevations on the sides of intermittent drainageways. In some places the subsoil and the weathered underlying material range from very fine sandy loam to loamy fine sand that contains a small percentage of coarse sand. As much as 20 percent of some mapped areas is Morrill silty clay loam or Burchard silty clay loam.

This Malcolm soil is easily worked and absorbs water readily. Runoff is moderate to rapid. Organic-matter content is moderately low.

Most areas are in native grasses and are used as range. Controlling grazing is the main management need. Some areas are cultivated. Wheat and alfalfa are the most suitable crops, but grain sorghum can be grown occasionally. Preventing runoff, conserving moisture, and reducing the hazard of erosion are the main management needs. Capability unit IVe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Mayberry Series

The Mayberry series consists of moderately sloping to strongly sloping, deep, moderately well drained soils on uplands. These soils formed in reworked glacial till (fig. 11) and commonly are covered by a thin layer of loess.

In a representative profile the surface layer is dark-gray silty clay loam about 10 inches thick. The upper part of the subsoil is dark grayish-brown, friable silty clay loam about 3 inches thick; the middle part is firm, reddish-brown and yellowish-red silty clay about 23 inches thick; and the lower part is firm, strong-brown silty clay about 6 inches thick. The underlying material is reddish-yellow silty clay loam.

Permeability is slow, and available water capacity is high. Natural fertility is medium.

Most areas are cultivated. Some areas are in native grasses and are used as range.

Representative profile of Mayberry silty clay loam. 3 to 7 percent slopes, eroded, under native grass, 792 feet west and 50 feet north of the southeast corner of sec. 16, T. 1 N., R. 4 E.

A—0 to 10 inches. dark-gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate, medium,

Figure 11.—**Profile of Mayberry silty clay loam. This soil formed in reworked glacial till. The scale is marked in feet.**

subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B1—10 to 13 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; slightly acid; clear, smooth boundary.

B21t—13 to 30 inches, reddish-brown (5YR 4/4) silty clay, reddish brown (5YR 4/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; very hard, firm; neutral; clear, smooth boundary.

B22t—30 to 36 inches, yellowish-red (5YR 5/6) silty clay, yellowish red (5YR 4/6) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; very hard, firm; neutral; clear, smooth boundary.

B3—36 to 42 inches, 80 percent strong-brown (7.5YR 5/6) and 20 percent light-brown (7.5YR 6/4) silty clay, dark brown (7.5YR 4/4) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; very hard, firm; mildly alkaline; gradual, smooth boundary.

C—42 to 60 inches, 80 percent reddish-yellow (7.5YR 6/6) and 20 percent pink (7.5YR 7/4) silty clay loam, strong brown (7.5YR 5/6) and brown (7.5YR 4/4) moist; moderate, coarse, blocky structure parting to moderate, medium, blocky structure; very hard, firm; mildy alkaline.

The A horizon generally is silty clay loam or clay loam, but it is clay in the severely eroded soils. Clay content of the subsoil ranges from 38 to 48 percent. The solum ranges from 40 to 55 inches in thickness, and the lower part of the solum and the upper part of the underlying material commonly have faint to distinct, strong-brown to reddish-yellow mottles. Coarse gravel and small stones are common in some areas, but they make up less than 1 percent of the volume throughout the profile.

The Mayberry soil in mapping unit MadC3 is lighter colored and has a more clayey surface layer than is defined as the range for the series. The difference does not alter the usefulness or behavior of the soil.

Mayberry soils are associated with the Crete, Morrill, and Burchard soils. They are below the Crete soils that formed on loess-capped uplands. They are finer textured than Morrill and Burchard soils. They have less lime in the lower part of the subsoil than Burchard soils.

Mayberry silty clay loam, 3 to 7 percent slopes, eroded (MaaB2).—This soil is at the lower elevations on ridgetops and on sides of upland drainageways. It has a profile similar to the one described as representative of the Mayberry series, but moderate erosion has thinned the surface layer to about 8 inches in thickness. Some cultivated areas have numerous, small, glacial stones on the surface. Areas of this soil in native grass have a few, small, partly exposed boulders. As much as 20 percent of some mapped areas consists of the associated Crete and Morrill soils.

This Mayberry soil puddles readily if it is worked or grazed when too wet. Runoff is medium. Organic-matter content is moderate. Available water capacity is high. Root penetration is limited, and water movement is slow in the clayey subsoil.

Most of the acreage is cultivated. This soil is suited to all the commonly grown crops. Controlling erosion, reducing runoff, and conserving moisture are the main management needs. Water management is the main need in irrigated areas. Some areas are in native grass and are used as range. Keeping a vigorous stand of grasses is the main management need in areas used as range. Capability units IIIe–2 dryland and IIIe–21 irrigated; Clayey range site; Silty to Clayey windbreak suitability group.

Mayberry silty clay loam, 7 to 11 percent slopes (MaaC).—This soil is on sides of drainageways and on hillsides between upland drainageways. Partly exposed glacial stones or boulders are in some areas. Included in mapping are small areas of Morrill and Burchard soils.

Runoff ranges from medium to rapid depending on the amount of vegetation. Organic-matter content generally is moderate. The clayey subsoil somewhat limits root penetration and restricts water movement.

This soil is suited to cultivation, but most of the acreage is used as range and for hay. Maintaining a vigorous stand of grass is the main management need. Wheat and alfalfa are the principal crops, and occasionally corn and grain sorghum are grown. Conservation practices are needed in cultivated areas. Capability unit IVe–2 dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Mayberry clay, 3 to 11 percent slopes, severely eroded (MadC3).—This soil is on ridgetops and hillsides. It has a profile similar to the one described as representative of the series, but the surface layer is lighter colored and more compact and is silty clay or clay about 5 inches thick. Part of the subsoil has been mixed into the plow

layer in most areas. Small glacial stones commonly are on the surface in some areas.

Organic-matter content is low, and natural fertility is medium to low. Runoff is rapid. Root penetration and water movement are somewhat limited by the compacted clayey subsoil.

Most of the acreage is cultivated. Wheat, alfalfa, grain sorghum, and corn are the most suitable crops. Controlling erosion, reducing runoff, improving fertility, and conserving moisture are the main management needs. Some areas formerly cultivated have been seeded to native grass. Capability unit IVe–2 dryland; Clayey range site; Silty to Clayey windbreak suitability group.

Meadin Series

The Meadin series consists of moderately sloping to steep, shallow, excessively drained soils (fig. 12) on uplands. These soils formed in loamy deposits overlying coarse sand and gravel. They are along intermittent drainageways that drain into the Little Blue River and Big Sandy Creek.

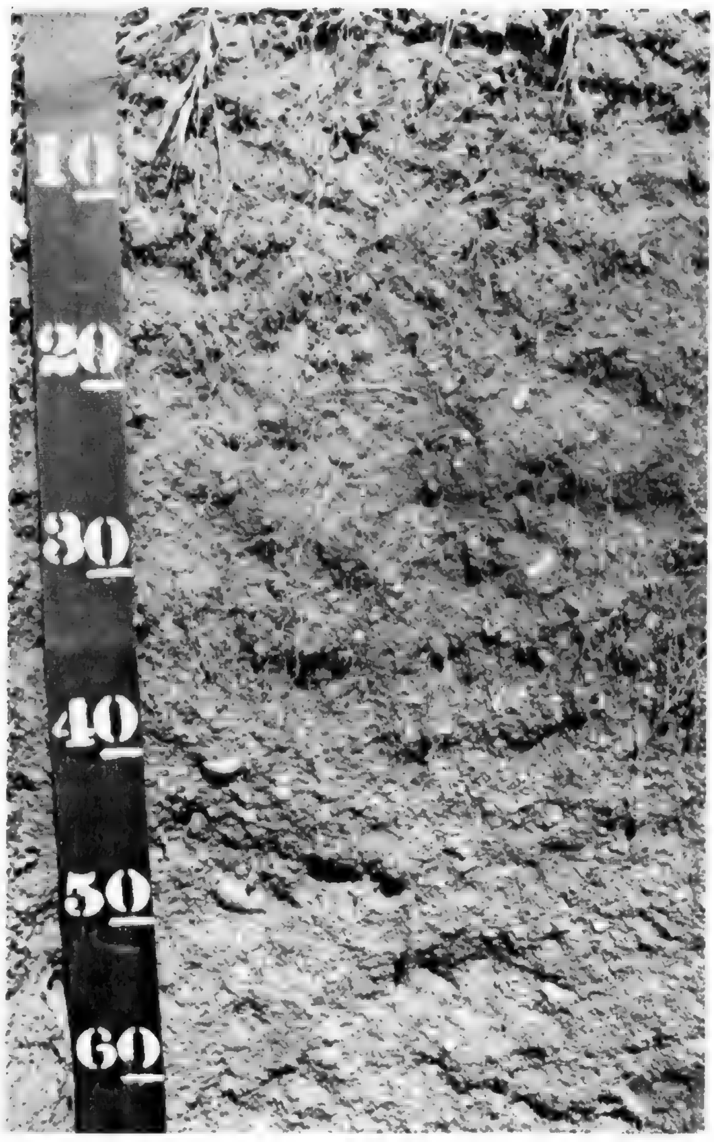


Figure 12.—**Profile of Meadin loam, 7 to 30 percent slopes. This is a shallow soil underlain by stratified coarse sand and gravel. The scale is marked in centimeters.**

In a representative profile the surface layer is grayish-brown loam in the upper 5 inches and dark-gray gravelly sandy loam in the lower 9 inches. In most areas gravel is scattered throughout the surface layer. Below the surface layer is a transitional layer of grayish-brown, friable gravelly sandy loam about 4 inches thick. The upper 9 inches of underlying material is light brownish-gray coarse sand and gravel, and below this is very pale brown sand and gravel. Depth to the underlying material is about 18 inches.

These soils are somewhat droughty. Available water capacity is low. Permeability is rapid in the transitional layer and very rapid in the sand and gravel. Natural fertility is low.

Most of the acreage is in native grass and is used as range. Droughtiness, erodibility, and slope make these soils unsuitable for cultivation.

Representative profile of Meadin loam, 7 to 30 percent slopes, under native grasses, 1,666 feet south and 630 feet west of the northeast corner of sec. 15, T. 3 N., R. 1 E.

A11—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to weak, medium, granular structure; few pebbles; soft, friable; slightly acid; clear, smooth boundary.

A12—5 to 14 inches, dark-gray (10YR 4/1) gravelly sandy loam, very dark gray (10YR 3/1) moist; weak, medium, subangular blocky structure parting to weak, medium, granular structure; few pebbles; soft, friable; slightly acid; clear, smooth boundary.

AC—14 to 18 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; single grained; loose, friable; slightly acid; gradual, smooth boundary.

IIC1—18 to 27 inches, light brownish-gray (10YR 6/2) coarse sand and gravel, dark grayish brown (10YR 4/2) moist; single grained; loose; slightly acid; gradual, wavy boundary.

IIC2—27 to 44 inches, very pale brown (10YR 7/3) sand and gravel, pale brown (10YR 6/3) moist; single grained; loose; slightly acid.

The profile varies within short distances. Depth to coarse sand and gravel ranges from 8 inches to as much as 20 inches, depending on the topography, the degree of erosion, and the pattern of deposition of the loamy material over the sand and gravel. Few to many coarse pebbles are scattered throughout the profile.

Meadin soils are associated with Jansen, Geary, and Morrill soils. They are shallower than Jansen soils. They are shallower and less clayey than Geary soils which formed in loess, and Morrill soils, which formed in reworked till.

Meadin loam, 7 to 30 percent slopes (MwD).—This soil is in irregularly shaped areas on sides and tops of ridges along intermittent upland drainageways. As much as 20 percent of some mapped areas is Jansen soils.

Runoff is medium to rapid, depending on the slope. Organic-matter content is low. Shallowness over coarse sand and gravel makes these soils droughty and limits root penetration and moisture storage.

This soil is not suitable for cultivation. Most of the acreage is in native grass and is used as range. Controlling grazing, keeping grass vigorous, preventing runoff, and conserving moisture are the main management needs. Some formerly cultivated areas are severely eroded.

Capability unit VIs-4 dryland; Shallow to Gravel range site; Shallow windbreak suitability group.

Morrill Series

The Morrill series consists of moderately sloping to steep, deep, well-drained soils on uplands. These soils formed in material reworked from glacial till (fig. 13).

In a representative profile the surface layer is dark-gray clay loam about 10 inches thick. The subsoil is friable clay loam about 32 inches thick. The upper 5 inches is dark grayish brown, the next 19 inches is dark brown and brown, and the lower 8 inches is light yellowish-brown. The subsoil is more compact than the surface layer. The underlying material is very pale brown clay loam.

Permeability is moderately slow, and available water capacity is high. Natural fertility is medium to high.

Steep areas are in native grass and are used mainly as range. Moderately sloping and strongly sloping areas are suited to cultivation.

Representative profile of Morrill clay loam, 3 to 7 percent slopes, under native grass, 792 feet west and 100 feet south of the northeast corner of NW¼ of sec. 22, T. 2 N., R. 3 E.

A—0 to 10 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky structure parting to moderate, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

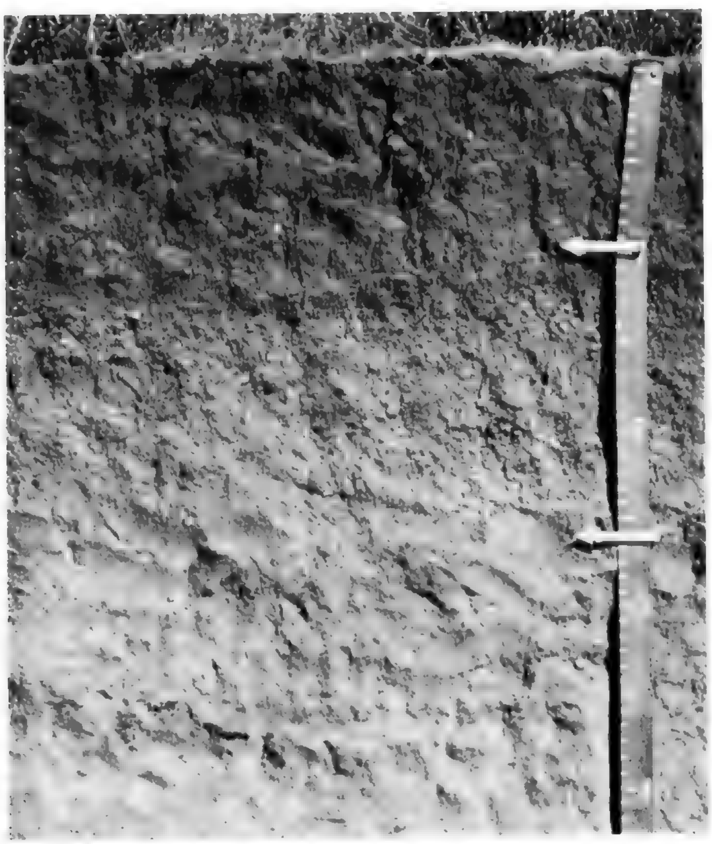


Figure 13.—Profiel of Morrill soil. This soil is deep and has pebbles throughout the profile. The scale is marked in fett and inches.

B1—10 to 15 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky structure; few pebbles; slight hard, friable; slightly acid; clear, smooth boundary.

B21t—15 to 24 inches, dark-brown (7.5YR 4/4) clay loam, dark brown (7.5YR 4/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; few pebbles; hard, friable; slightly acid; clear, smooth boundary.

B22t—24 to 34 inches, brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; few pebbles; hard, friable; slightly acid; clear, smooth boundary.

B3—34 to 42 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; few pebbles; hard, friable; neutral; clear, smooth boundary.

C1—42 to 54 inches, very pale brown (10YR 74) clay loam, brown (10YR 5/3) moist; moderate, coarse, subangular blocky structure parting to moderate, medium, subangular blocky structure; few pebbles; hard, friable; neutral; slight effervescence; clear, smooth boundary.

C2—54 to 60 inches, very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky structure; hard, friable; slight effervescence; neutral.

The B horizon generally is clay loam, but in some places it is sandy clay loam. In some places pockets of gravelly material occur, generally below a depth of 40 inches. Small pebbles are scattered throughout most profiles. The C horizon generally is noncalcareous, but in places where the texture is more clayey, it has some carbonates.

The Morrill soil in mapping unit MC3 has a lighter colored surface layer than is defined as the range for the series, but this difference does not alter the usefulness or behavior of the soil.

Morrill soils are associated with Burchard, Mayberry, and Geary soils. They generally lack carbonates that are in the Burchard soils at a depth of less than 30 inches. They have a less clayey subsoil than Mayberry soils. They have clay loam textures, but Geary soils formed in loess and have silty clay loam textures.

Morrill clay loam, 3 to 7 percent slopes (MrB).—This soil is in irregularly shaped areas on sides and tops of ridges. It has the profile described as representative of the Morrill series. As much as 20 percent of some mapped areas consists of Mayberry and Geary soils.

The workability of this Morrill soil is good. Runoff is medium. Organic-matter content is moderate. Natural fertility is high.

This soil is suitable for cultivation, but most of the acreage is used as range or for hay. Maintaining a vigorous stand of grasses is the main management need. This soil is suited to all crops commonly grown in the county if moisture is conserved, runoff is controlled, and the hazard of erosion is reduced. Irrigated areas need proper management of water. Capability units IIIe-1 dryland and IIIe-1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Morrill clay loam, 3 to 7 percent slopes, eroded (MrB2).—This soil is on ridgetops and sides of drainageways. It has a profile similar to the one described as representative of the series, but the surface layer is only 5 to 8 inches thick. Included in mapping are a few areas of lighter colored, severely eroded soils and small areas of Mayberry and Geary soils.

Runoff is medium. Organic-matter content is moderate, and tilth is good. Natural fertility is medium.

Most of the acreage is cultivated. Grain sorghum, corn, wheat, and alfalfa are the principal crops. Reducing runoff, controlling erosion, and conserving moisture are management needs. Grain sorghum and corn are the principal irrigated crops. Managing water is the main concern in irrigated areas. Capability units IIIe–1 dryland and IIIe–1 irrigated; Silty range site; Silty to Clayey windbreak suitability group.

Morrill clay loam, 7 to 11 percent slopes (MrC).—This soil is on the lower parts of hillsides along intermittent drainageways. It has a profile similar to that described as representative of the Morrill series, but the thickness of the surface layer and subsoil is more variable in the more sloping areas. Included in mapping are small areas of Burchard and Geary soils.

Runoff is medium to rapid depending on the vegetation. Natural fertility is high, and organic-matter content is moderate.

Most areas are used for hay or as range. Maintaining a vigorous stand of grasses is the main management need. If conservation practices are used, this soil is suitable for cultivation. Suitable crops are wheat, alfalfa, corn, and grain sorghum. Capability unit IVe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Morrill clay loam, 11 to 30 percent slopes (MrE).—This soil is along intermittent drainageways. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are thinner. Slopes are dominantly about 20 percent but range from 11 to 35 percent. As much as 25 percent of some mapped areas consist of Burchard soils.

Steep slopes cause rapid runoff. Natural fertility is medium, and organic-matter content is moderate to moderately low.

Steep slopes make this soil unsuitable for cultivation. Most of the acreage is in native grasses and is used as range. Several small areas that formerly were cultivated have been seeded to grass. Maintaining a vigorous stand of grass, increasing infiltration of moisture, and controlling erosion are the main management needs. Capability unit VIe–1 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Morrill soils, 3 to 11 percent slopes, severely eroded (MC3).—These soils are on ridgetops and hillsides between intermittent drainageways. They have a profile similar to the one described as representative of the series, but the surface layer is thinner, lighter colored, and ranges from sandy clay loam to silty clay loam. Heavy rainfalls make rills and crossable gullies on the hillsides.

Runoff is rapid. Natural fertility is medium to low, and organic-matter content is low. These soils puddle readily if worked when to wet.

Most areas are cultivated. Reducing runoff, controlling erosion, conserving moisture, and improving fertility are the main management needs. These soils are suited to native grasses and to use as range. Keeping a vigorous stand of grass is the main concern in range management. Capability unit IVe–8 dryland; Silty range site; Silty to Clayey windbreak suitability group.

Rough Stony Land

Rough stony land (31 to 50 percent slopes) (Rv) consists of breaks of exposed shale, sandstone, and limestone bedrock adjacent to intermittent stream channels and drainageways. The texture of the soil material ranges widely, but is mainly silty clay loam to loam. As much as 80 percent, but generally about 40 percent, of the surface is exposed bedrock.

Included in mapping are small areas of Kipson, Benfield, Hedville, and Lancaster soils and areas of very shallow soils that overlie the bedrock.

Rough stony land is excessively drained. Runoff is rapid and very rapid. Permeability is slow, and available water capacity is low. Organic-matter content and fertility are low.

The vegetation varies according to the depth of the soil over bedrock. Most areas are used as range. Controlling grazing and conserving moisture are the main management concerns. Capability unit VIIs–3 dryland; Shallow Sandy range site; Undesirable windbreak suitability group.

Sandy Alluvial Land

Sandy alluvial land (0 to 3 percent slopes) (Sx) consists of water-deposited sand bars and sand flats within and adjacent to the Little Blue River and Big Sandy Creek and in old channels of the river and creek. Areas are irregular in size and are marked with low mounds and channels formed by floodwaters. The size and shape of the areas tend to change with the more intensive streamflow during high water. The flood plains are 1 to 3 feet above normal streamflow.

Sandy alluvial land is stratified with moderately coarse, coarse, and very coarse textured soil material. The alluvium is recent, but has been in place long enough for plants to become established.

Sandy alluvial land supports annual weeds, brush, and willows, but it is scoured and cut by floodwaters and the plant cover is unstable. Dense stands of willows, cottonwoods, annual weeds, and common reedgrass grow in old channels, where the soil material is more stable. Sandy alluvial land is not well suited to grazing. The more densely vegetated areas provide wildlife habitat. Capability unit VIIIw–1 dryland; Undesirable windbreak suitability group; not assigned to a range site.

Silty Alluvial Land

Silty alluvial land (0 to 3 percent slopes) (Sy) is along narrow, intermittent and permanent flowing streams. Most areas have meander channels and are bordered by short, steep slopes.

Silty alluvial land consists of dark-colored, dominantly medium-textured sediment that is alluvium washed from the surrounding uplands. Included in mapping are a few small areas of Hobbs soils.

Available water capacity is high, and permeability is moderate. Areas are frequently flooded after heavy rains, which occur several times each year.

Many trees grow adjacent to channels in the more stable areas, and a fair cover of grasses is in level areas and on short slopes.

Silty alluvial land is not suitable for cultivation, because the areas are too small and too irregularly shaped. Most of the acreage is pasture. Capability unit VIw-1 dryland; Silty Overflow range site; Undesirable windbreak suitability group.

Wet Alluvial Land

Wet alluvial land (0 to 1 percent slopes) (Wx) is on bottom lands below the upland breaks near Crystal Lake and Alexandria Lakes (fig. 14). It consists of stream sediments that are kept permanently wet by seepage along the edge of the valley. Areas are ponded during a part of each year, and the water table is within a depth of 18 inches. These sediments are dark colored, stratified, and range from silt loam to silty clay. The material is mottled and generally is calcareous. In many places an inch or more of organic matter is on the surface. Included in mapping are small areas of marshy soils.

Wet alluvial land has poor natural drainage. Runoff is very slow or ponded. The native vegetation consists of water-tolerant grasses, cattails, rushes, sedges, and in places, a few willow trees. Wet alluvial land is used for limited grazing. The more thickly vegetated areas provide wildlife habitat. Capability unit Vw-1 dryland; Wet Land Range site; Undesirable windbreak suitability group.

Use and Management of the Soils

This section provides information on the use of the soils for dryland and irrigated crops; information on the range sites of the different soils in the county, their management, and their potential for producing native grass; and information on the native woodland and the suitability of the soils for windbreaks and specified kinds of trees.

This part of the survey also suggests ways of improving wildlife habitat and reports data from engineering tests and interpretations of soil properties that affect highway construction and other engineering structures.

Management of the Soils for Crops [2]

Water erosion on sloping soils, flooding of soils adjacent to streams and drainageways, loss of fertility through erosion, poor tilth, and an inadequate supply of organic matter are the main concerns in Jefferson County. Most of the soils are suited to crops. Soils that are unsuited are the steep soils; the shallow Meadin, Hedville, and Kipson soils; and Sandy alluvial land, Silty alluvial land, Wet alluvial land, Rough stony land, and

[2] Prepared by ERVIN O. PETERSON, conservation agronomist, Soil Conservation Service.

Figure 14.—Shallow ditches dug in Wet alluvial land. These ditches provide more open water area for waterfowl.

Gravel pits. The soils suited to crops are also suited to pasture. All but Gravel pits are suited to pasture. All but Rough stony land, Gravel pits, and Sandy alluvial land are suited to windbreak plantings. All provide habitat for wildlife and suitable sites for recreation.

Approximately 65 percent of the county is cultivated, and 5 percent is pastured. According to the 1971 Nebraska Agricultural Statistics, approximately 30,200 acres of cropland was irrigated. The principal irrigated crops are corn, grain sorghum, and alfalfa. The principal dryland crops are wheat, grain sorghum, alfalfa, and corn. Crops grown less extensively on both dryland and irrigated acreages are oats, barley, soybeans, and tame hay.

Erosion caused by rainfall can be controlled by terracing, contour farming, land leveling, contour bench leveling, and seeding grass in waterways. These practices are suited to Crete, Geary, Hastings, and other soils that have slopes of no more than 11 percent. The practices are most effective if used in combination with other good soil management practices. Keeping crop residue on the surface or growing a protective plant cover prevents the soil from sealing or crusting after intensive rains. Tall stubble left standing in winter to catch drifting snow helps in replenishing soil moisture on dryfarmed soils.

The cropping system can be managed so that the highly productive, less erodible soils are used mainly for row crops and the steeper, more erodible soils and unprotected areas are used mainly for hay and pasture.

Soil blowing generally is not a concern on the soils of Jefferson County, but large, wide, exposed fields that are plowed in fall are subject to soil blowing in winter. Stubble mulch tillage of small grain crops, mulch planting for row crops, and a cropping system that eliminates plowing in fall reduce wind velocity on the soil surface and thus reduce the movement of soil particles by wind action.

Minimum tillage during seedbed preparation and equipment that leaves maximum crop residue on the surface improve tilth, reduce soil losses, and lessen compaction.

Tame grass pasture can be grown in rotation with cultivated crops to supplement native range and provide a longer grazing period. Tame grass pastures yield more forage than native range, but are more costly. Consequently, only soils of fairly high productivity should be used for tame pasture.

Introduced cool-season grass species, such as bromegrass, are most commonly used in tame grass pastures in Jefferson County. When tame pasture begins to deteriorate, it can be renovated by plowing up the old stand and reseeding the area to a desirable grass mixture. Sudangrass can be seeded to provide temporary pasture during the hot months of July and August. A combination of cool-season pasture plants, warm-season grasses on rangeland, and temporary pastures of sudangrass provide grazing for livestock throughout the growing season.

Soil tests should be taken on soils used for crops and pasture to determine the need for commercial fertilizer. Applications of fertilizer on dryland soils can be adjusted to the supply of soil moisture. Smaller applications are needed in places where the subsoil is dry or the rainfall is low than where the soil moisture is more favorable. Nitrogen fertilizer increases plant growth on nearly all soils in the county. Phosphorus and zinc are commonly needed on the eroded Geary, Hastings, and Crete soils on uplands. Irrigated soils require larger amounts of fertilizer in order to supply the need of the greater plant population and the higher yields.

Not all the soils that are suited to crops are suited to irrigation. The steeper Edalgo, Burchard, Geary, Hastings, Malcolm, Morrill, Jansen, Lancaster, Crete, and Mayberry soils are better suited to dryland crops, pasture, and range than to irrigated crops. Sprinkler irrigation, however, can be used on these soils. Sprinkler systems are suited to all soils that are suitable for irrigation. Several types of sprinklers can be used, including the self-propelled sprinklers that require only a small amount of labor. Gravity irrigation systems distribute water through furrows, borders, or corrugations. Row crops are irrigated by furrows. Small grain and hay and pasture plants are better suited to sprinkler, border, and corrugation irrigation.

Control of water erosion is needed on the irrigated, sloping soils. Land leveling to reduce slope gradient and irrigating on the contour along with bench leveling or terracing on the steeper slopes help to reduce the hazard of erosion in gravity irrigated areas. Terracing, contour farming, and grassed waterways help to reduce soil losses in sprinkler irrigated areas. Application rates of irrigation water can be adjusted to the intake rate of the soils. Maintaining the maximum amount of crop residue on the surface helps to reduce the hazard of erosion and improves the moisture intake rate.

Runoff irrigation water and runoff from excessive rainfall can be conserved by constructing a water storage pit, from which the stored water can be recycled into the irrigation system. Most of the irrigation water is obtained from deep wells. In January 1972, there were 280 irrigation wells registered in the county. Water for small fields is also supplied by pumping plants along flowing streams, from reservoirs, and from storage pits.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification (*8*) can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The num-

erals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife.
- Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* used in only some parts of the United States, but not in Jefferson County, shows that the chief limitation is climate that is too cold to too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the dryland and irrigated capability units in Jefferson County are described and use and management is suggested for the soils in each unit.

Capability unit numbers are generally assigned locally, but are part of a statewide system. All of the units in the system are not represented by the soils of Jefferson County; therefore the numbers are not consecutive.

CAPABILITY UNITS I-1 DRYLAND AND I-1 IRRIGATED

These units consist of the deep, well-drained soils of the Cass, Hobbs, and Hord series. These are nearly level and gently sloping soils on bottom lands and stream terraces. The surface layer is medium textured. The subsoil and underlying material are medium textured to moderately coarse textured.

These soils absorb water readily and are easily worked. Runoff is slow to medium. Permeability is moderate to moderately rapid. Available water capacity is high in Hobbs and Hord soils and low in Cass soils. Hobbs and Hord soils are high in natural fertility, and Cass soils are moderate. Organic-matter content is moderate.

Maintaining a high level of fertility and increasing the organic-matter content are the principal management needs. If the surface is not adequately protected, the soils are subject to soil blowing.

Dryland management.—Corn, grain sorghum, small grain, alfalfa, and tame grasses are suitable dryland crops. Soybeans are grown on a limited acreage. A cropping system that provides good management of crop residue and adequate additions of fertilizer is about all that is needed to maintain these soils for sustained crop production. Keeping a cover of plants or organic matter on the surface helps to prevent soil blowing. Diseases and insects can be controlled by using a crop sequence that alternates row crops with small grain, hay, and pasture crops.

Irrigation management.—Corn, grain sorghum, small grain, alfalfa, and tame grasses are suited to the irrigated soils (fig. 15). All types of irrigation are suitable. Unless the soil is leveled, slight irregularities in the land surface commonly make it difficult to obtain uniform distribution of water in gravity irrigation. Crop residue left on the surface during winter helps control soil blowing. Irrigation water must be applied in sufficient amount to serve the needs of the crops and at a rate that permits maximum absorption and minimum runoff.

CAPABILITY UNITS IIe-1 DRYLAND AND IIe-1 IRRIGATED

These units consist of gently sloping soils of the Hastings, Hobbs, and Hord series. These are deep, well-drained soils on uplands, foot slopes, and stream terraces. They have a medium-textured surface layer and a medium-textured to moderately fine textured subsoil.

These soils absorb water readily and are easily worked. Runoff is slow to medium. Permeability is moderate to moderately slow, and available water capacity is high. Organic-matter content is moderate, and natural fertility is high.

Water erosion is a slight hazard. Control of runoff is needed to reduce erosion and increase soil moisture. Maintaining good tilth and a high level of fertility and supply of organic matter are additional needs in cultivated fields.

***Figure 15.*—Hobbs silt loam, 0 to 1 percent slopes. This soil is well suited to irrigated corn.**

Dryland management.—Corn, small grain, grain sorghum, alfalfa, and tame grasses are the dryland crops best suited. Wheat and grain sorghum are the main crops. Corn, small grain, and alfalfa are satisfactory crops during years when the moisture supply is favorable. A cropping system that includes mulch planting, such as stubble-mulch tillage, and summer fallow is valuable in conserving soil moisture. Terraces, contour farming, and grassed waterways are examples of runoff control measures. Commercial fertilizers and barnyard manure improve fertility.

Irrigation management.—Corn and grain sorghum are the main irrigated crops. A smaller acreage of alfalfa is also irrigated. For efficient gravity irrigation, some leveling generally is needed. Leveling provides an even distribution of irrigation water. Crop residue on the surface increases the water intake rate and prevents soil blowing. Controlling or conserving irrigation runoff at the ends of fields is needed. Sprinklers also are suitable on these soils.

CAPABILITY UNITS IIe-2 DRYLAND AND IIIe-2 IRRIGATED

Crete silt loam, 1 to 3 percent slopes, is the only soil in these units. It is a deep, gently sloping claypan soil on uplands. It has a medium-textured surface layer and a fine-textured subsoil.

Runoff is medium. Permeability is slow, and available water capacity is high. Natural fertility is high. The organic-matter content is moderate.

This soil is somewhat droughty because the subsoil absorbs moisture slowly and releases it slowly to plants. Controlling runoff, reducing the hazard of erosion, and increasing soil moisture are the principal management needs.

Dryland management.—Wheat, grain sorghum, corn, alfalfa, and grasses are suitable dryland crops. Wheat is best suited because it matures before the driest and warmest part of the summer. Grain sorghum is better suited than corn.

Conserving moisture helps to sustain production. Contour farming and terraces reduce runoff, control erosion, and help to hold water until it can be absorbed by the soil. A tillage system that leaves a maximum amount of crop residue on the surface helps to prevent loss of moisture, especially in fall and winter.

Irrigation management.—Corn, grain sorghum, and alfalfa are the crops best suited if this soil is under irrigation. Some land leveling is generally needed to prepare this soil for irrigation. If the subsoil is exposed during leveling, undercutting and backfilling with 6 inches of topsoil can be considered. Sprinklers, furrows. and borders can be used for irrigating. Application rates of

water must be controlled so as not to exceed the intake rate of the soil. Applications of commercial fertilizers or barnyard manure are needed for sustained crop production.

Runoff from rainfall and irrigation can be controlled by terracing, contour farming, bench leveling, and adjusting the row direction to provide for a lower grade of furrow. Controlling irrigation runoff at the ends of fields by using an irrigation pit helps to conserve water. Water collected in the pits can be recycled to irrigate the same field or other fields.

CAPABILITY UNITS IIs-2 DRYLAND AND IIs-2 IRRIGATED

Crete silt loam, 0 to 1 percent slopes, is the only soil in these units. It is a deep, nearly level claypan soil on uplands. It has a medium-textured surface layer and a fine-textured subsoil.

Runoff is slow. Permeability is slow, and available moisture capacity is high. Organic-matter content is moderate, and natural fertility is high. The fine-textured subsoil somewhat restricts the movement of air and water and limits the penetration of roots.

This soil is somewhat droughty during dry years because the subsoil absorbs moisture slowly and releases it slowly to plants. Maintaining good tilth and a high level of fertility and improving the organic-matter content are management needs in cultivated areas.

Dryland management.—Wheat, grain sorghum, corn, and alfalfa are suitable dryland crops. Wheat is the best suited because it matures before the advent of hot, dry weather. Grain sorghum is better suited than corn.

Moisture can be conserved by limiting tillage and by keeping crop residue on the surface. These practices help the soil absorb moisture and minimize the loss of moisture through evaporation. Soil moisture can be increased in wheatfields by combining summer fallowing and stubble-mulch tillage. If fertility is maintained and the surface is protected from soil blowing and water erosion, this soil can be used for row crops year after year.

Irrigation management.—Corn, grain sorghum, and alfalfa are the crops best suited if this soil is irrigated. Sprinklers, furrows, and borders can be used for irrigating. Water application rates must be controlled so as not to exceed the intake rate of the soil. If the subsoil is exposed during land leveling, undercutting and backfilling with 6 inches of topsoil can be considered. Applications of commercial fertilizers or barnyard manure are needed for sustained crop production. Irrigation water storage pits can be used to recycle water and utilize the runoff from fields.

CAPABILITY UNITS IIw-2 DRYLAND AND IIs-21 IRRIGATED

Butler silt loam is the only soil in these units. It is a deep, nearly level somewhat poorly drained claypan soil in shallow depressions in uplands. The surface layer is medium textured and the subsoil is fine textured. This soil is flooded for short periods by runoff from surrounding higher lying soils.

Runoff is very slow. Permeability is slow, and available water capacity is high. Organic-matter content is moderate, and natural fertility is medium.

Excessive wetness following heavy rains in spring is the main limitation in cultivated areas. The wetness causes the soil to stay cool and thus delays tillage and retards crop growth.

Dryland management.—Small grain, corn, grain sorghum, and alfalfa are suitable dryland crops. Wheat and grain sorghum are best suited. Wetness can be controlled by installing terraces and diversions on the adjoining higher lying areas to divert runoff from this soil. Keeping the soil covered with a growing crop or with crop residue helps to maintain the organic-matter content and control soil blowing during periods of drought.

Irrigation management.—Corn, grain sorghum, alfalfa, small grain, and grasses are suitable irrigated crops. Including alfalfa in the cropping system helps to open the subsoil and increase the movement of water through the soil. The slow intake rate makes longer irrigation periods necessary. Land leveling generally is needed to prepare the soil for irrigation. Also needed is water management that reduces irrigation water runoff.

Sprinklers, furrows, and borders can be used for irrigating. Water application rates must be controlled so as not to exceed the intake rate. Wetness can be reduced by building terraces and diversions on the adjoining higher lying areas to divert runoff from this soil.

CAPABILITY UNITS IIw-3 DRYLAND AND I-2 IRRIGATED

These units consist of occasionally flooded soils of the Cass and Hobbs series. These are deep, nearly level soils on bottom lands along the major streams and intermittent drainageways. The surface layer is medium textured, and the subsoil is medium textured or moderately coarse textured. Runoff from the surrounding uplands occasionally floods these soils.

These soils absorb water readily and are easily worked. Runoff is slow. Permeability is moderate to moderately rapid. The Hobbs soil is high in available water capacity and natural fertility. The Cass soil is low in available water capacity and moderate in natural fertility. Organic-matter content is moderate in both soils.

Occasional flooding following heavy rains is the major hazard in cultivated areas. The duration of flooding is short, and the damage to crops is seldom severe. The level of fertility needs to be maintained.

Dryland management.—Under dryland farming, these soils are suited to corn, grain sorghum, small grain, alfalfa, and grasses. Occasional flooding in spring can limit production of small grain and alfalfa. During dry years, occasional minor flooding is beneficial to row crops because it adds to the moisture supply.

Diversions to divert floodwaters and drainage ditches to remove the water can be used in most areas. Management practices that maintain and keep drainage ditches and diversions clear of obstructions are needed if the structures are to intercept and divert floodwater.

Irrigation management.—Under irrigation, these soils are best suited to corn and grain sorghum. Alfalfa, small grain, and grasses are also suited if flooding is controlled.

Sprinkler and gravity irrigation systems are suited to these soils. An irrigation system that provides for diverting and intercepting floodwaters is needed. Land leveling is needed in places. Leveling is needed to provide surface drainage and an even distribution of irrigation water if furrows and borders are used for irrigating.

Reducing or controlling irrigation runoff at the ends of fields is also needed.

Mulch tillage and adequate applications of commercial fertilizers are needed where irrigated crops are grown.

CAPABILITY UNITS IIIe-1 DRYLAND AND IIIe-1 IRRIGATED

These units consist of uneroded and eroded, moderately sloping soils of the Burchard, Geary, Hastings, Morrill, Jansen, and Lancaster series. These are deep and moderately deep, well-drained soils on uplands. They have a medium-textured or moderately fine textured surface layer and subsoil. Sand and gravel underlie the Jansen soils at a depth of about 32 inches. Sandstone and shale underlie the Lancaster soils at a depth of about 26 inches.

These soils are easily worked. The organic-matter content is moderately low to moderate. Water is absorbed and released readily to plants. Runoff is medium. Permeability is moderate to moderately slow. The available water capacity is low in Jansen and Lancaster soils and high in the rest. Natural fertility is medium to low in Jansen and Lancaster soils and medium to high in the rest.

Water erosion is the principal hazard in cultivated areas. Measures are needed to control runoff, reduce erosion, and increase soil moisture. Keeping the soil fertile and in good tilth and improving the organic-matter content are additional management concerns.

Dryland management.—Corn, grain sorghum, wheat, alfalfa, and grasses are suitable dryland crops.

Terraces, grassed waterways, contour farming, and the use of crop residue as mulch reduce runoff and erosion. Moisture can be conserved and water erosion and soil blowing controlled by using a cropping system that keeps the soil covered with crops or residue most of the time, by limiting the year of consecutive row crops, and by including such close-growing crops as small grain, alfalfa, and grass. Mulch tillage during seedbed preparation supplements mechanical erosion control practices. Commercial fertilizer or barnyard manure is needed.

Irrigation management.—Alfalfa and tame grasses are well suited to irrigation. Corn and grain sorghum are suited if adequate erosion control is provided. Terraces, contour irrigation, waterways, and crop residue on the surface are examples of erosion control measures. Manure and commercial fertilizer improve fertility.

Sprinklers are the most suitable for irrigating. The slope makes it difficult to control water erosion under natural rainfall and water from irrigation. The rate of water application should not exceed the intake rate of the soil.

Furrow and border irrigation can be used if land leveling has been extensive enough and water erosion and runoff are held to a minimum. Contour bench leveling is suitable for the lower slope gradients. Reducing or controlling irrigation runoff at the end of the field is needed.

CAPABILITY UNITS IIIe-2 DRYLAND AND IIIe-21 IRRIGATED

These units consist of eroded, moderately sloping soils of the Crete, Edalgo, Mayberry, and Benfield series. These are deep and moderately deep, well drained and moderately well drained soils on uplands. They have a moderately fine textured surface layer and a fine textured subsoil. The Benfield soil is about 28 inches deep over limestone bedrock. The Edalgo soil is about 28 inches deep over clayey shale.

These soils are sticky when wet and hard when dry. They have to be tilled at the proper moisture content. Runoff is medium. Water is absorbed and released slowly to plants because the subsoil is fine textured. Permeability is moderately slow to very slow. The available water capacity ranges from low to high. Natural fertility is medium, and organic-matter content is moderately low.

Water erosion and loss of good tilth are the principal hazards in cultivated areas. Practices that control runoff, reduce erosion, and increase soil moisture are needed. Improving tilth, the content of organic matter, and the level of fertility and increasing the intake of moisture are additional management concerns.

Dryland management.—Grain sorghum, corn, wheat, and alfalfa are suitable dryland crops. Wheat and grain sorghum are best suited. A suitable cropping system limits the years of consecutive row crops in the rotation and thus provides more time for grain, alfalfa, tame grasses, and other close-growing crops that can resist erosion.

Protecting these soils against further erosion is essential. Terracing and contour farming are needed (fig. 16). Grassed waterways can provide safe disposal of excess runoff. Mulch planting for row crops and stubble mulch tillage for summer fallow and seedbed preparation reduce the risk of erosion and supplement mechanical erosion control practices. Commercial fertilizer or barnyard manure is needed.

Irrigation management.—Alfalfa and tame grasses are well suited irrigated crops. Corn and sorghum are suited if erosion control is provided. Terraces, contour irrigation, grassed waterways, and crop residue on the surface are examples of erosion control measures. Manure and commercial fertilizer improve fertility.

Sprinklers are best for irrigating these soils. The slope and low water absorption rate make it difficult to control water erosion resulting from both natural rainfall and irrigation runoff. Water application rates must be carefully controlled so as not to exceed the intake rate of the soil.

Furrow and border irrigation can be used if land leveling has been extensive enough and water erosion and runoff are at a minimum. Contour bench leveling is suitable for the lower slope gradients. Subsoil material exposed during leveling can be undercut and refilled with topsoil. Zinc fertilizer can be added to the extensively cut areas to help restore fertility. Phosphorus fertilizer benefits legumes. Reducing or controlling irrigation runoff at the ends or lower edges of fields is needed.

CAPABILITY UNIT IVe-1 DRYLAND

This unit consists of uneroded and eroded, strongly sloping soils of the Burchard, Geary, Hastings, Malcolm, Morrill, Jansen, and Lancaster series. These are deep and moderately deep, well-drained soils on uplands. They have a medium-textured or moderately fine textured surface layer and subsoil. Jansen soils are underlain by mixed sand and gravel at a depth of about 32 inches.

Figure 16.—Crete silty clay loam, 3 to 7 percent slopes, eroded. Contouring and terracing are needed on this soil.

Lancaster soils are underlain by sandstone bedrock at a depth of about 26 inches.

Runoff is medium to rapid. Permeability is moderate to moderately slow. Available water capacity is low in Jansen and Lancaster soils and high in the rest. Natural fertility is low in Jansen and Lancaster soils and medium to high in the rest. The organic-matter content ranges from low to moderate.

Water erosion is the principal hazard in cultivated areas. Controlling runoff reduces erosion and increases the soil moisture. Keeping the soil fertile and in good tilth and improving the organic-matter content are additional management concerns.

Alfalfa, tame grasses, and wheat are the crops best suited to these soils. Grain sorghum and corn can be limited in the cropping sequence so as to include more close growing crops like small grain, alfalfa, and grasses. In addition to the cropping system, terraces, contour farming, grassed waterways, and the use of crop residue in mulch tillage are needed. Jansen and Lancaster soils should be used mostly for tame grass and wheat because they are only moderately deep over sand and gravel or bedrock. They are not well suited to terraces because construction is likely to expose this underlying material. The level of fertility can be improved and maintained by using commercial fertilizer and barnyard manure. The soils are too steep to be suited to irrigation.

CAPABILITY UNIT IVe-2 DRYLAND

This unit consists of uneroded and eroded, strongly sloping soils of the Benfield, Crete, Edalgo, and Mayberry series and the severely eroded Mayberry soils. These are deep and moderately deep, well-drained soils on uplands. They have a medium-textured to fine-textured subsoil. Benfield soils are about 28 inches deep over limestone bedrock. Edalgo soils are about 28 inches deep over clayey shale.

Runoff is medium to rapid. Permeability is slow. Available water capacity is low in Benfield and Edalgo soils and high in the rest. Water is released slowly to plants. Natural fertility is medium, and the organic-matter content is low to moderate.

These soils are marginal for cultivated crops because of the serious erosion hazard. They are generally not suited to irrigated crops. The major management need is controlling water erosion. Improving tilth and the level of fertility and increasing the organic-matter content are management concerns.

Tame grasses and wheat are the close-sown crops best suited to these soils. Alfalfa is well suited to Crete and Mayberry soils, but it is only moderately well suited to Benfield and Edalgo soils. A suitable cropping system is 1 year of row crops and then alternate years of small grain and tame grass. In addition to the cropping system, terraces, contour farming, grassed waterways, and the

use of crop residue and mulch tillage are needed for erosion control.

These soils are suited to pasture, range, windbreak plantings, wildlife habitat, and recreation. The hazard of water erosion can be reduced by converting these soils to grassland for pasture or range. Leaving about half of the yearly plant growth on the soil after the growing season reduces the hazard of water erosion (fig. 17).

CAPABILITY UNIT IVe-8 DRYLAND

This unit consists of moderately sloping to strongly sloping, severely eroded soils of the Burchard, Geary, Hastings, Jansen, Lancaster, and Morrill soils. These are deep and moderately deep, well-drained soils on uplands. Most of the original surface layer and part of the subsoil have been removed, mainly by water erosion. The present surface layer and subsoil are medium textured to moderately fine textured. Jansen soils are about 3 feet deep over sand and gravel. Lancaster soils are about 26 inches deep over sandstone bedrock.

Runoff is medium to rapid. Permeability is moderate to moderately slow. Available water capacity is low in Jansen and Lancaster soils and high in the rest. Fertility is medium to low. The organic-matter content is low because erosion has been severe.

These soils are marginal for cultivated crops. Controlling water erosion, improving the level of fertility, and increasing the organic-matter content are the major management needs.

Alfalfa, tame grass, and wheat are the close-growing crops best suited to these soils. A suitable cropping system is 1 year of row crops and then alternate years of small grain, alfalfa, and tame grass. In addition to the cropping system, terraces, contour farming, grassed waterways, and the use of crop residue and mulch tillage are needed for erosion control. The level of fertility can be improved and maintained by using commercial fertilizers.

These soils are also suited to pasture, range, windbreak plantings, wildlife habitat, and recreation. The hazard of water erosion can be reduced by converting cultivated areas to grassland and using them for hay or pasture. Leaving about half of the yearly growth of plants on the soil after the growing season helps to reduce the hazard of water erosion.

CAPABILITY UNIT Vw-1 DRYLAND

Only Wet alluvial land is in this unit. It is nearly level, deep, and medium textured to fine textured, is on bottom land, and is wet most of the year. The water table fluctuates seasonally from the surface to a depth of 18 inches. It is at the surface during a part of each year. Natural drainage is very poor.

Figure 17.—Benfield silty clay loam, 7 to 11 percent slopes. This soil is used primarily for native hay.

Runoff is very slow to ponded. Permeability is moderately to very slow.

Excessive wetness is the major hazard. None of the acreage is suitable for cultivation. Drainage is not practical in most areas.

Some areas are used for limited grazing. Bogs form in pastures that are grazed when the water level is at or near the surface. Some areas adjacent to streams are densely wooded and the grass cover is sparse.

Wet alluvial land is best suited to wildlife habitat and recreation.

CAPABILITY UNIT VIe-1 DRYLAND

This unit consists of steep soils of the Benfield, Burchard, Geary, Morrill, Jansen, Lancaster, and Edalgo series. These are deep and moderately deep, well-drained soils on uplands. They have a medium-textured to moderately fine textured surface layer and a medium-textured to fine-textured subsoil. Benfield soils are about 28 inches deep over limestone bedrock. Jansen soils are about 3 feet deep over sand and gravel. Lancaster and Edalgo soils are about 3 feet deep over interbedded sandstone and clayey shale.

Runoff is rapid. Permeability is moderately slow to slow. The available water capacity is high in the Burchard, Geary, and Morrill soils and low in the rest. Natural fertility is medium to low. The organic-matter content is moderate.

Overgrazing is the principal management concern in areas used as range. Water erosion is a hazard in overgrazed areas. Management practices that keep the grass healthy and vigorous reduce runoff and the hazard of erosion and increase soil moisture.

These soils are best suited to range. Uncultivated areas can be converted to range by seeding to native grass. The soils are also suited to trees and windbreak plantings and to the development of wildlife habitat and recreational areas.

Stockwater dams, erosion control structures, and flood detention reservoirs can be built in the bottom of some drainageways.

CAPABILITY UNIT VIs-4 DRYLAND

This unit consists of shallow soils of the Hedville, Kipson, and Meadin series. These are strongly sloping to steep, somewhat excessively drained soils on uplands. They have a medium-textured surface layer and medium-textured or moderately coarse textured underlying material. Hedville soils are underlain by sandstone bedrock at a depth of 6 to 20 inches. Kipson soils are underlain by limestone bedrock at a depth of 8 to 20 inches. Meadin soils are underlain by mixed sand and gravel at a depth of 10 to 20 inches.

Runoff ranges from medium to rapid. Permeability ranges from moderate to rapid, and available water capacity is low. Organic matter content is low to moderately low, and natural fertility is medium to low.

Droughtiness is the principal hazard. The soils are suited to range (fig. 18), and most of the acreage is used for this purpose. They can also be used as wildlife habitat and recreational areas. Cultivated areas can be converted to range by seeding a mixture of native grasses. Grazing should be controlled on both native and seeded areas so that at least half of the yearly plant growth is left on the surface as mulch.

CAPABILITY UNIT VIw-1 DRYLAND

Only Silty alluvial land is in this unit. It is in narrow areas on bottom land along intermittent and permanent streams and is frequently flooded. It is deep, stratified light- and dark-colored, mainly medium-textured sediment that washed from surrounding uplands. It is nearly level in the channel bottoms and steep on the nearly vertical banks formed by meandering intermittent streams.

Permeability is moderate, and available water capacity is high. Organic-matter content and natural fertility are high.

The deeply entrenched stream channels, inaccessibility, and frequent flooding are the major limitations.

Silty alluvial land is best suited to range and to development of wildlife habitat and recreational areas. Some areas are used as range. Proper range management helps maintain the vigor of the grasses. In many areas, grass is sparse because flooding is frequent and the numerous native trees provide excessive shade.

Erosion control structures can be built if care is used in selecting the sites. Large floodwater retention structures help to reduce flooding on areas below the structures.

CAPABILITY UNIT VIIs-3 DRYLAND

Only Rough stony land is in this unit. It is very steep, very shallow, and excessively drained. It is on uplands, on breaks where much bedrock is exposed. Medium-textured soil material no more than 10 inches thick makes up about 60 percent of the acreage.

Runoff is very rapid. Permeability is moderate, and available water capability is very low. The organic-matter content and natural fertility are low.

Rough stony land provides limited grazing. It is used by wildlife for cover and as a source of food. Management practices that maintain a good cover of grass are needed to reduce the hazard of water erosion and to conserve as much soil moisture as possible on the steep slopes.

CAPABILITY UNIT VIIIw-1 DRYLAND

Only Sandy alluvial land is in this unit. It is nearly level, stratified moderately coarse textured to very coarse textured, water-deposited sediment in old channel areas, 1 to 3 feet above the normal stream flow, adjacent to the Little Blue River and Big Sandy Creek. It is frequently flooded. The water table is at the surface and areas are ponded during periods of high streamflow. The water table fluctuates between depths of 1 and 4 feet when the streams are dry.

Sandy alluvial land is not suited to cultivated crops, pasture, or tree plantings. It is best suited to wildlife habitat and recreation.

CAPABILITY UNIT VIIIs-1 DRYLAND

Gravel pits, the only mapping unit in this capability unit, consists of deep excavations from which gravel has been removed. Many of these pits are partly filled with water. Adjacent to the pits are many steep piles of sand. Trees, mainly cottonwoods and willows, are common

Figure 18.—**Typical area of Hedville loam, 7 to 30 percent slopes. This soil is in native grass.**

around the pits. These areas are mainly on uplands. A few are on bottom lands of the Little Blue River. Gravel pits have few uses except as a source of sand and gravel. Some areas on bottom lands, where the pit is partly filled with water, can be developed for recreational uses.

Predicted Yields

The predicted average yields per acre of the principal crops grown in Jefferson County are shown in table 2. The yields are shown under two levels of management for both irrigated soils and dryland soils. Yields in columns A can be expected under average management, and those in columns B under high level management.

Average management (A level) is the management used by most farmers in the county.

Applications of fertilizer and lime are moderate. Practices that control erosion and maintain good tilth and the supply of organic matter and available nitrogen are most likely short of optimum requirements. Cultural practices, such as controlling weeds, disease, and insects and using certified seed, may or may not be used.

Correcting deficiencies and improving the timeliness of management practices, selecting better crop varieties, and increasing plant populations are likely to result in significant increases in productivity.

High level management (B level) is within the capability of most farmers in the county. It is the application, according to present knowledge, of those agricultural practices needed for any specific combination of soils, crops, livestock, and climate. These practices relate to drainage, irrigation, and erosion control; proper tillage and weed, insect, and disease control; top quality seed; the application of limestone, phosphate, and nitrogen based on the need indicated by soil tests and past treatments; a suitable cropping system; and the efficient use of crop residue to improve tilth and maintain a high content of organic matter.

The yield predictions in table 2 are based on information furnished by supervisors of the Jefferson County Soil and Water Conservation District and representatives of the Soil Conservation Service and on observations and comparisons made by others who are familiar with the soils and agriculture of the county. These estimates are averages per seeded acre using tried and proven methods over the past 5 years. They take into account the years of favorable as well as unfavorable moisture supply, but do not include losses from unpredictable causes.

TABLE 2.—*Predicted average yields per acre of principal crops under two levels of management*

[Figures in columns A are yields obtained under customary management; those in columns B are yields obtained under improved management. Absence of figure indicates crop is not commonly grown on the soil at the level of management specified or that irrigation is not practical. Only arable soils are listed]

Soil	Grain sorghum				Wheat		Corn				Alfalfa			
	Dryland		Irrigated		Dryland		Dryland		Irrigated		Dryland		Irrigated	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Benfield silty clay loam, 3 to 7 percent slopes, eroded	45	60	70	90	19	27	32	40	65	85	2.3	3.5	3.1	3.7
Benfield silty clay loam, 7 to 11 percent slopes	36	58			17	25	28	38			2.2	3.2		
Benfield silty clay loam, 7 to 11 percent slopes, eroded	29	42			13	19	19	29			2.0	2.8		
Burchard clay loam, 3 to 7 percent slopes	49	67	83	102	20	27	31	41	77	100	2.2	3.0	3.4	4.0
Burchard clay loam, 7 to 11 percent slopes	39	54			17	25	27	37			2.0	2.7		
Burchard clay loam, 7 to 11 percent slopes, severely eroded	35	48			15	23	23	33			1.7	2.5		
Butler silt loam	50	69	84	118	22	30	28	46	86	115	2.0	2.5	3.8	4.8
Cass loam	62	81	89	118	22	30	54	70	90	123	2.5	3.5	4.0	5.5
Cass loam, occasionally flooded	60	79	86	115	20	29	52	68	86	118	2.5	3.5	4.0	5.5
Crete silt loam, 0 to 1 percent slopes	55	74	94	133	27	36	39	52	95	140	2.5	3.5	4.0	5.0
Crete silt loam, 1 to 3 percent slopes	52	71	92	129	26	35	38	51	95	131	2.4	3.3	3.8	4.8
Crete silt loam, 7 to 11 percent slopes	34	47			14	21	25	34			1.7	2.6		
Crete silty clay loam, 3 to 7 percent slopes, eroded	48	65	80	100	18	25	31	41	77	98	2.0	2.8	3.2	4.2
Edalgo silty clay loam, 3 to 7 percent slopes, eroded	29	39	42	63	13	19	24	33	38	55	2.0	2.6	3.0	3.6
Edalgo silty clay loam, 7 to 11 percent slopes	27	35			12	18	20	29			1.8	2.6		
Geary silty clay loam, 3 to 7 percent slopes	52	69	87	106	22	30	33	41	80	102	2.2	3.3	3.4	4.0
Geary silty clay loam, 3 to 7 percent slopes, eroded	50	68	85	104	21	28	32	42	79	101	2.2	3.3	3.4	4.0
Geary silty clay loam, 7 to 11 percent slopes	38	53			16	24	26	36			1.8	2.8		
Geary silty clay loam, 3 to 11 percent slopes, severely eroded	34	47			14	22	22	32			1.7	2.7		
Geary and Jansen soils, 5 to 11 percent slopes	22	32			11	17	14	22			1.5	2.0		
Geary and Jansen soils, 5 to 11 percent slopes, eroded	21	30			11	17	13	21			1.5	2.0		
Geary and Jansen soils, 5 to 11 percent slopes, severely eroded	15	24			10	14	11	18			1.3	1.7		
Hastings silt loam, 1 to 3 percent slopes	54	74	95	132	28	37	40	53	97	136	2.5	3.4	3.5	4.5
Hastings silt loam, 3 to 7 percent slopes	51	68	86	106	22	30	34	44	80	104	2.2	3.3	3.4	4.0
Hastings silt loam, 7 to 11 percent slopes	39	53			17	25	27	37			2.0	2.7		
Hastings silty clay loam, 3 to 7 percent slopes, eroded	50	67	85	105	21	29	33	43	79	102	2.2	3.2	3.4	4.0
Hastings silty clay loam, 3 to 11 percent slopes, severely eroded	33	48			14	23	21	31			1.8	2.7		
Hobbs silt loam, occasionally flooded	64	79	97	132	20	27	63	78	98	124	2.7	3.8	3.0	5.8
Hobbs silt loam, 0 to 1 percent slopes	70	83	106	140	28	38	72	85	112	145	2.7	3.8	3.0	5.8
Hobbs silt loam, 1 to 3 percent slopes	55	75	96	134	29	38	41	54	98	135	2.6	3.4	3.6	4.7
Hord silt loam, 0 to 1 percent slopes	68	81	106	140	28	38	70	83	112	145	2.7	3.6	3.7	4.5
Hord silt loam, 1 to 3 percent slopes	55	75	96	134	29	38	41	54	98	135	2.6	3.4	3.6	4.7
Jansen loam, 3 to 7 percent slopes	26	35	55	73	12	19	17	25	45	64	1.6	2.2	2.5	3.1

527-044—75——4

TABLE 2.—*Predicted average yields per acre of principal crops under two levels of management*—Continued

Soil	Grain sorghum				Wheat		Corn				Alfalfa			
	Dryland		Irrigated		Dryland		Dryland		Irrigated		Dryland		Irrigated	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Jansen loam, 3 to 7 percent slopes, eroded	*Bu.* 25	*Bu.* 35	*Bu.* 55	*Bu.* 75	*Bu.* 12	*Bu.* 19	*Bu.* 16	*Bu.* 24	*Bu.* 45	*Bu.* 65	*Tons* 1.6	*Tons* 2.2	*Tons* 2.5	*Tons* 3.1
Jansen loam, 7 to 11 percent slopes	22	32	------	------	11	17	15	22	------	------	1.4	1.8	------	------
Lancaster loam, 3 to 7 percent slopes, eroded	38	52	58	78	13	21	22	29	55	70	2.3	3.2	2.7	3.4
Lancaster loam, 7 to 11 percent slopes	25	33	------	------	11	16	15	22	------	------	1.5	1.9	------	------
Lancaster soils, 7 to 11 percent slopes, severely eroded	19	25	------	------	10	14	12	19	------	------	1.2	1.7	------	------
Malcolm silt loam, 7 to 11 percent slopes, eroded	24	32	------	------	12	18	15	22	------	------	1.7	2.0	------	------
Mayberry silty clay loam, 3 to 7 percent slopes, eroded	47	62	78	93	21	28	30	40	73	92	2.3	3.4	3.0	4.0
Mayberry silty clay loam, 7 to 11 percent slopes	36	51	------	------	15	23	24	34	------	------	1.9	2.8	------	------
Mayberry clay, 3 to 11 percent slopes, severely eroded	32	44	------	------	17	24	30	42	------	------	1.6	2.3	------	------
Morrill clay loam, 3 to 7 percent slopes	52	68	85	103	23	29	34	43	79	100	2.2	3.3	3.3	3.9
Morrill clay loam, 3 to 7 percent slopes, eroded	50	68	83	102	21	28	32	42	77	99	2.1	3.2	3.3	3.9
Morrill clay loam, 7 to 11 percent slopes	39	52	------	------	17	25	25	37	------	------	2.0	2.7	------	------
Morrill soils, 3 to 11 percent slopes, severely eroded	35	48	------	------	15	23	23	33	------	------	1.8	2.7	------	------

Management of the Soils for Range [3]

Range, generally acreages not suitable for cultivation, makes up about 30 percent of the total land area in Jefferson County. It occurs in the Lancaster-Hedville, Benfield-Kipson, Jansen-Geary, and Morrill-Burchard soil associations. Raising livestock, mainly cows and calves, and selling the calves as feeders in fall is the largest farm enterprise in the county.

Range sites and condition classes

Different kinds of range produce different kinds and amounts of native vegetation. For proper range management, an operator should know the different kinds of range sites in his holding and the native plants each site can grow. Management can then favor the growth of the best forage plants on each site.

A range site is a distinctive kind of range that differs from other range sites in its ability to produce a significantly different kind and amount of climax, or original, vegetation. A significant difference is one great enough to require some variation in management, such as a different stocking rate. Climax vegetation, or potential native plant cover, is the stabilized plant community on a given site. It is generally the most productive combination of range plants on the site.

Climax vegetation can be altered by intensive grazing. Livestock graze selectively, seeking the more palatable and nutritious plants. Decreasers and increasers are climax plants. Generally, *decreasers* are the first to decrease under heavy, continuous grazing. *Increasers* withstand grazing better because they are less palatable to the livestock. They increase under grazing and replace the decreasers. Invaders are weeds that become established after the climax vegetation has been reduced by grazing.

Range condition is classified according to the percent of original, or climax, vegetation on the site. It includes the degree to which the composition of the existing plant community differs from the climax vegetation. Changes in range condition are caused primarily by differences in intensity of grazing and by differences in seasonal moisture, especially during prolonged dry periods. Four condition classes are recognized. A range is in *excellent* condition if 76 to 100 percent of the vegetation is climax; it is in *good* condition if 51 to 75 percent is climax; in *fair* condition if 26 to 50 percent is climax; and in *poor* condition if 25 percent or less is climax.

Managing and improving range

Proper grazing use, deferred grazing, and a planned grazing system help to maintain or improve the range condition. The distribution of livestock in a pasture can be improved by the correct location of fences and water and salting facilities.

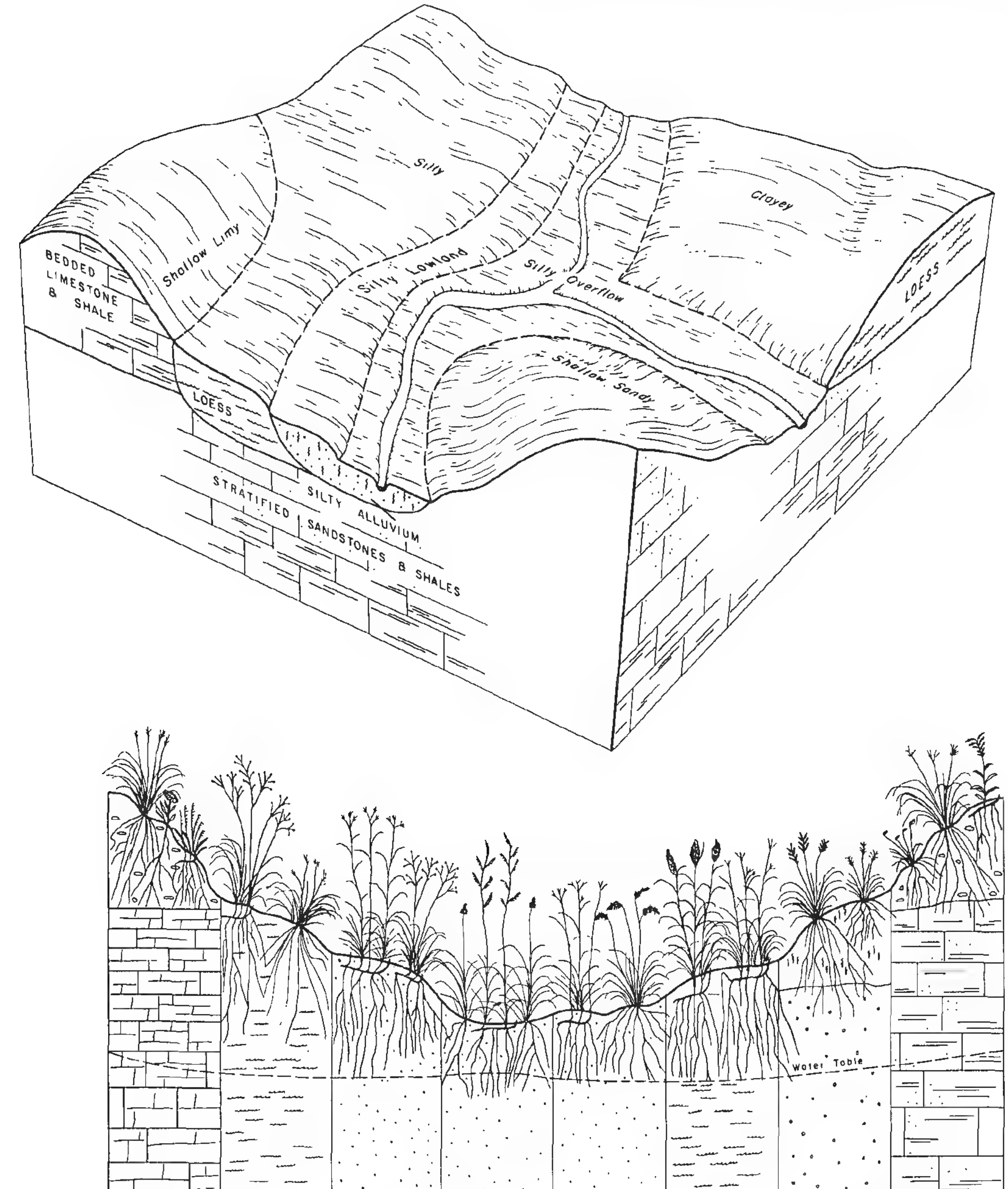
Range seeding, that is, establishing native grass by seeding or reseeding either wild harvest or improved strains, also can be considered on land suitable for use as range. Soils, such as Hastings silty clay loam, 3 to 11 percent slopes, severely eroded, and Lancaster soils, 7 to 11 percent slopes, severely eroded, that are still used for

[3] Prepared by PETER N. JENSEN, range conservationist, Soil Conservation Service.

crops can be seeded to range. The most important grasses in the seed mixture are big bluestem, little bluestem, indiangrass, switchgrass, and side-oats grama. Good grazing management is needed to maintain forage production.

Descriptions of range sites

The eight range sites (fig. 19) in Jefferson County are described in the paragraphs that follow. The soil series represented is named in the description of each site, but this does not mean that all the soils of a given series are



Range Site	Shallow Limy	Clayey	Silty Lowland	Wet Land	Silty Overflow	Silty	Shallow To Gravel	Shallow Sandy
Soil Series or Land Type	Kipson	Crete	Hobbs	Wet Alluvial Land	Hobbs Occasionally Flooded	Geary	Meadin	Hedville

Figure 19.—Top: **Distribution of range sites in associations 1, 2, 6, and 7.** ***Bottom:*** **Range sites and representative soils.**

in that site. To find the range site designation for any given soil, refer to the "Guide to Mapping Units" at the back of this survey. Sandy alluvial land supports unstable vegetation and is therefore not assigned to a range site.

WET LAND RANGE SITE

This site consists only of nearly level Wet alluvial land on bottom land. A high water table fluctuates from the surface to a depth of 18 inches during most of the year. It is at the surface during part of the year. The surface layer and underlying material range from silt loam to silty clay loam.

The climax, or potential, plant community is approximately 50 to 75 percent prairie cordgrass, 15 to 25 percent sedges, 5 to 15 percent perennial forbs, and 10 percent or less reed canarygrass.

Under continued heavy grazing or mowing, prairie cordgrass, reed canarygrass, and some sedges decrease. Other sedges and Kentucky bluegrass increase if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 5,000 pounds per acre, air-dry weight, in unfavorable years to a high of 6,000 pounds in favorable years.

SILTY OVERFLOW RANGE SITE

This site is on bottom land that is flooded periodically by stream overflow or runoff from adjacent areas. It consists of nearly level soils of the Cass and Hobbs series and Silty alluvial land. The surface layer is silt loam or loam, and the underlying material is silt loam to sandy loam. The available water capacity ranges from low to high. Permeability is moderate to moderately rapid.

The climax, or potential, plant community is approximately 50 to 60 percent big bluestem, 10 to 20 percent switchgrass, 5 to 15 percent indiangrass, 5 to 10 percent sedges, 5 to 10 percent little bluestem, 10 percent or less Canada wildrye, 10 percent or less prairie cordgrass, and 5 percent or less perennial forbs.

Under continued heavy grazing or mowing, big bluestem, Canada wildrye, indiangrass, prairie cordgrass, switchgrass, and little bluestem decrease. Sedges, Kentucky bluegrass, Baldwin ironweed, verbenas, willows, and annual grasses increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 4,000 pounds per acre, air dry weight, in unfavorable years to a high of 5,000 pounds in favorable years.

SILTY LOWLAND RANGE SITE

This site is on bottom land and stream terraces. It is seldom flooded, but receives some moisture from higher elevations. It consists of nearly level to very gently sloping soils of the Cass, Hobbs, and Hord series. The surface layer is silt loam or loam, and the underlying material is silt loam to sandy loam. The available water capacity ranges from low to high. Permeability is moderate to moderately rapid.

The climax, or potential, plant community is approximately 50 to 60 percent big bluestem, 10 to 20 percent little bluestem, 5 to 15 percent switchgrass, 5 to 10 percent indiangrass, and 10 percent or less sedges. Tall dropseed, Canada wildrye, porcupinegrass, and perennial forbs each make up 5 percent or less.

Under continued grazing or mowing, big bluestem, Canada wildrye, indiangrass, switchgrass, and little bluestem decrease. Sedges, blue grama, Kentucky bluegrass, western ragweed, Baldwin ironweed, verbenas, and annual grasses increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 3,500 pounds per acre, air-dry weight, in unfavorable years to a high of 4,500 pounds in favorable years.

SILTY RANGE SITE

This site consists of the gently sloping to steep soils of the Benfield, Burchard, Geary, Hastings, Jansen, Lancaster, Malcolm, and Morrill series. These are deep and moderately deep, well-drained soils on uplands. The surface layer and subsoil range from loam to clay loam. Permeability is moderate to moderately slow. The available water capacity ranges from low to high.

The climax, or potential, plant community is approximately 30 to 40 percent little bluestem, 30 to 40 percent big bluestem, 10 to 20 percent switchgrass, 10 to 20 percent indiangrass, and 5 to 10 percent sedges. Canada wildrye, prairie dropseed, and side-oats grama each make up 10 percent or less, and perennial forbs 5 percent or less.

Under continued grazing or mowing, big bluestem, Canada wildrye, indiangrass, switchgrass, and little bluestem decrease. Sedges, blue grama, Kentucky bluegrass, sand dropseed, western ragweed, verbenas, and annual grasses increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 3,000 pounds per acre, air-dry weight, in unfavorable years to a high of 4,000 pounds in favorable years.

CLAYEY RANGE SITE

This site consists of nearly level to steep soils of the Benfield, Butler, Crete, Edalgo, and Mayberry series. These are deep soils that have a silty clay loam to clay subsoil. They are on uplands. The available water capacity ranges from low to high. Permeability is moderately slow to slow.

The climax, or potential, plant community is approximately 20 to 30 percent little bluestem, 20 to 30 percent big bluestem, 15 to 25 percent switchgrass, 10 to 20 percent indiangrass, 5 to 10 percent tall dropseed, and 5 to 10 percent side-oats grama. Prairie dropseed, sedges, and perennial forbs each make up 5 percent or less.

Under continued grazing or mowing, big bluestem, indiangrass, switchgrass, and little bluestem decrease. Sedge, blue grama, Kentucky bluegrass, tall dropseed, western ragweed, verbenas, and annual grasses increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 2,500 pounds per acre, air-dry weight, in unfavorable years to a high of 3,500 pounds in favorable years.

SHALLOW LIMY RANGE SITE

This site consists only of shallow Kipson silt loam, 7 to 30 percent slopes. This soil is on uplands. The surface layer is calcareous silt loam, and the underlying material is interbedded limestone and shale. Permeability is moderate. The available water capacity is low.

The climax, or potential, plant community is approximately 40 to 50 percent little bluestem, 15 to 25 percent side-oats grama, and 15 to 25 percent big bluestem. Switchgrass, hairy grama, and indiangrass each make up 5 to 10 percent, and prairie dropseed and perennial forbs, 5 percent or less.

Under continued grazing, big bluestem, little bluestem, prairie dropseed, indiangrass, and switchgrass all decrease. Hairy grama, side-oats grama, Kentucky bluegrass, annual grasses, and such woody plants as smooth sumac and buckbrush increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 2,000 pounds per acre, air-dry weight, in unfavorable years to a high of 3,000 pounds in favorable years.

SHALLOW SANDY RANGE SITE

This site is on uplands. It consists of Hedville loam, 7 to 30 percent slopes, and Rough stony land. These soils are shallow. The surface layer is loam, and the underlying material is interbedded sandstone and shale. Permeability is moderate. The available water capacity is low.

The climax, or potential, plant community is approximately 40 to 50 percent little bluestem, 15 to 25 percent big bluestem, 5 to 15 percent switchgrass, 5 to 10 percent sand dropseed, 5 to 10 percent blue grama, and 5 percent or less, perennial forbs.

Under continued grazing, big bluestem, little bluestem, and switchgrass decrease. Blue grama and sand dropseed increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 1,500 pounds per acre, air-dry weight, in unfavorable years to a high of 2,500 pounds in favorable years.

SHALLOW TO GRAVEL RANGE SITE

This site consists only of Meadin loam, 7 to 30 percent slopes. This is a shallow soil on uplands. The surface layer is loam, and the underlying material is stratified sand and gravel. Permeability is rapid. The available water capacity is low.

The climax, or potential, plant community is aproximately 25 to 30 percent little bluestem, 15 to 25 percent big bluestem, and 10 to 15 percent blue grama. Switchgrass, sedges, and sand dropseed each make up 5 to 10 percent, and Scribner panicum, sedges, and perennial forbs each 5 percent or less.

Under continued grazing, little bluestem, big bluestem, and switchgrass decrease. Sand dropseed, blue grama, and Scribner panicum increase or invade if the site is overused.

If the site is in excellent condition, the total annual production ranges from a low of 1,500 pounds per acre, air-dry weight, in unfavorable years to a high of 2,500 pounds in favorable years.

Management of the Soils for Woodland and Windbreaks [4]

Native woodland in Jefferson County is limited to narrow strips along the larger streams. The most extensive stands are on bottom land along the Little Blue River and on the lower slopes of Hedville soils and Rough stony land. The stands are predominantly American elm, bur oak, cottonwood, eastern redcedar, hackberry, honeylocust, green ash, maple, walnut, and willow. Much of the woodland is grazed and has become overstocked with undesirable tree species. Black walnut, which has a ready market and high value, is being depleted rapidly. If well managed, this species could be established. Stands of black walnut would help control erosion along the streambanks and provide a source of future income.

Early settlers in Jefferson County planted trees for protection, shade, and fenceposts. Throughout the years, landowners have continued to plant trees to protect buildings and livestock. Native trees and shrubs contribute to the natural beauty of the landscape and provide food and cover for wildlife.

Windbreak suitability groups

Because native trees are scarce in Jefferson County and severe extremes of weather prevail, windbreaks are needed for protection of farmsteads, livestock, and soils. They reduce home heating costs, control snow drifting, provide shelter for livestock, improve conditions for wildlife, and beautify the home and countryside.

Trees are not easily established in the county, but healthy seedlings properly planted and maintained in good condition can survive and grow well. They require care after planting if they are to continue to survive.

Table 3 shows the relative vigor and expected height, at 20 years of age, of trees suitable for windbreaks in this county. Tree measurements were taken on soils in the three major windbreak suitability groups in this county. The soils in each group are similar in characteristics that affect tree growth.

Ratings in table 3 are based upon the general vigor and condition of the trees. A rating of *excellent* indicates that the trees are growing well, the leaves have good color, no dead branches appear in the upper part of the crown, and no damage by fungi or insects is evident. A rating of *good* indicates that trees are growing moderately well, there are only a few dead branches and some dieback in the upper part of the crown, and damage by fungi or insects is only slightly evident. A rating of *fair* indicates that at least half of the trees have a significant number of dead branches in the upper part of the crown, about one-fourth of the trees are dead, growth has slowed significantly, and moderate damage by fungi or insects is evident. A rating of *poor* indicates that the remaining living trees have had severe dieback, more than one-fourth of the trees in the stand are dead, and severe damage by fungi or insects is evident.

The conifers, cedar and pine, are best suited to windbreaks. Measurements show that eastern redcedar and

[4] Prepared by JAMES W. CARR, JR., forester, Soil Conservation Service.

TABLE 3.—*Relative vigor and estimated height, by windbreak*

Windbreak group	Eastern redcedar		Ponderosa pine		Green ash		Hackberry	
	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height
		Ft.		*Ft.*		*Ft.*		*Ft.*
Silty to clayey	Excellent	22	Excellent	27	Excellent	27	Excellent	25
Moderately wet	Excellent	21	Poor	[1]	Good	29	Good	27
Shallow	Excellent	16	[2]	[2]	Poor	[1]	Poor	[1]

[1] Majority of trees dead or dying.

ponderosa pine, both native to Nebraska, are the most reliable windbreak species. Both are rated high in survival and vigor in the studies made. They hold their leaves through winter and provide maximum protection when it is most needed. Broadleaf trees that are well suited to use in windbreaks are honeylocust, green ash, hackberry, and mulberry. Suitable shrubs are lilac, bush honeysuckle, American plum, cotoneaster, and chokecherry.

Eastern redcedar can be expected to grow slightly more than 1 foot in height each year and can reach a mature height of 25 to 35 feet. Ponderosa pine and broadleaf trees grow slightly faster than eastern redcedar and are generally somewhat taller at maturity.

Rate of growth in a windbreak varies widely, depending on soil moisture conditions, soil fertility, exposure, and arrangement of species within the planting. Some species grow faster than others; some, for example, cottonwood, Siberian elm, and Russian-olive, make an early fast growth, but tend to die young. Siberian elm and Russian-olive also tend to spread. Boxelder and mulberry commonly freeze back in severe winters. Green ash is susceptible to damage by borers.

A good windbreak should be designed according to the intended purpose of the planting. Specific information on design, establishment, and care of windbreaks is available from foresters of the Soil Conservation Service and the Extension Service.

The soils in Jefferson County are grouped according to the characteristics that affect tree growth. The soil series represented in the windbreak suitability groups are named in the description of the group, but this does not mean that all the soils of a given series appear in that group. To find the names of all the soils in a group refer to the "Guide to Mapping Units" at the back of this survey. The growth and survival under normal weather conditions and care are similar for the soils in any one group. Following is a brief description of each windbreak group in Jefferson County and the trees and shrubs suitable for planting in each group.

SILTY TO CLAYEY WINDBREAK SUITABILITY GROUP

This group consists of deep and moderately deep, well drained, moderately well drained, and somewhat poorly drained soils on bottom land, benches, and uplands. These are soils of the Benfield, Burchard, Butler, Crete, Edalgo, Geary, Hastings, Hobbs, Hord, Jansen, Lancaster, Malcolm, Mayberry, and Morrill series. Their surface layer ranges from loam to silty clay loam, and their subsoil from silt loam to clay. The deep soils are underlain by loess or alluvium, and the moderately deep soils by limestone, sandstone, or gravel. Slopes range from nearly level to very steep.

Potential survival and growth of adapted species are good on this site. Drought and moisture competition from weeds and grasses are the principal limitations. Erosion is a hazard in sloping areas.

Conifers suitable for planting are eastern redcedar, Rocky Mountain juniper, ponderosa pine, Austrian pine, and Scotch pine. A suitable low broadleaf is Russian mulberry. Suitable tall broadleaf trees are hackberry, honeylocust, bur oak, green ash, and boxelder. Suitable shrubs are lilac, cottoneaster, honeysuckle, chokecherry, and American plum.

MODERATELY WET WINDBREAK SUITABILITY GROUP

This group consists of deep, nearly level, moderately well drained soils in the Cass and Hobbs series. All are on bottom land. The water table is high, and short duration flooding is frequent. The surface layer is loam or silt loam, and the subsoil and underlying material range from silt loam to sandy loam.

These soils are well suited to tree plantings if the species selected tolerates occasional wetness. Establishing the trees and cultivating between the rows can be difficult during wet years because herbaceous vegetation is abundant and persistent.

Conifers suitable for planting are eastern redcedar and Austrian pine. A suitable low broadleaf is Russian mulberry. Suitable tall broadleaf trees are honeylocust, green ash, cottonwood, golden willow, and white willow. Suitable shrubs are red-osier dogwood, buffaloberry, chokecherry, and American plum.

SHALLOW WINDBREAK SUITABILITY GROUP

This group consists of shallow, well-drained soils on uplands. These soils are in the Hedville, Kipson, and Meadin series. Their surface layer is loam or silt loam, and the underlying material is limestone, sandstone, or gravel. Slopes are strong to steep. A limited root zone and low available water capacity are the main limitations. Trees planted on this site are subject to drought in most years. The only species suitable for planting is eastern redcedar.

UNDESIRABLE WINDBREAK SUITABILITY GROUP

This group consists of Rough stony land, Silty alluvial land, Sandy alluvial land, and Wet alluvial land. All

suitability groups, of specified trees at 20 years of age

Honeylocust		Cottonwood		Russian-olive		Boxelder		Russian mulberry	
Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height
	Ft.		Ft.		Ft.		Ft.		Ft.
Good	28	Poor	(1)	Fair	21	(2)	(2)	Excellent	20
Good	33	Good	54	Poor	(1)	Excellent	18	Excellent	27
Poor	(1)	Poor	(1)	Poor	(1)	Poor	(1)	Poor	(1)

[2] Insufficient available data.

have a wide range of texture. All are flooded too frequently, are too wet for establishing tree plantings satisfactorily, and are too shallow for machine planting. None are suited to windbreak plantings. Some tree and shrub species that tolerate wetness can be planted in some recreational and wildlife areas.

Management of the Soils for Wildlife [5]

The natural wildlife habitat and the availability of water make Jefferson County attractive to the sportsman and the camper. Alexandria Lakes near Powell, Crystal Springs near Fairbury, the Little Blue River, Rose Creek, and the numerous watershed structures provide excellent waters for fishing and excellent areas for campsites nearby. Upland game birds are hunted throughout the county. Deer are mainly along the major streams and the wooded intermittent drainageways.

Wildlife management requires a knowledge of soils and the kinds of vegetation. The kind, amount, and distribution of vegetation largely determine the kinds and numbers of wildlife that can be produced and maintained. Fertility and topography affect the wildlife carrying capacity of an area. Fertile soils generally produce more wildlife. Water drained from such soils generally produces more fish than water drained from infertile soils. Topography affects wildlife through its influence on how the land is used. Rough, steep areas can be hazardous to livestock and are unsuitable for crop production, but undisturbed vegetation in such areas is valuable to wildlife. If vegetation is lacking in such areas, it can often be established.

Permeability and water intake rate are important soil characteristics in constructing dams for fish and in developing and maintaining wetland wildlife habitat for waterfowl. Marshy areas are suitable for the development of aquatic and semiaquatic habitat for waterfowl and some species of furbearers.

Soils that have the largest wildlife population do not necessarily rate highest in suitability for producing wildlife. The best soils for farming are intensively managed for crops, not for wildlife.

In the following paragraphs the kinds of wildlife, the habitat, and the potential for recreation in the soil associations in the county are described. For descriptions of the associations and general information about the soils and their use and management, refer to the section "General Soil Map."

Wooded tracts on bottom land of the Hobbs-Hord-Cass soil association and the edge vegetation along streams provide habitat for songbirds, deer, bobwhite, squirrel, cottontail, mourning dove, and other game species. This soil association furnishes abundant habitat for some furbearers, such as raccoon, opossum, and coyote. It is also inhabited by furbearers, such as mink, muskrat, and beaver, that require water. In places water is scarce. Marshy areas are used by waterfowl, mainly during spring and fall migration periods. The most important fishery in Jefferson County is the Little Blue River, which contains catfish, bullhead, and carp. The population of wild turkeys stocked by the Nebraska Game and Parks Commission in the drainage of the Little Blue River in Thayer County, directly west of Jefferson County, is likely to increase and spread into Jefferson County.

Soils in the Little Blue River Valley in the Hobbs-Hord-Cass association are among the poorest in the county for building sites and recreation activities. Some parts, however, offer possibilities for recreational development. Poor drainage and the hazard of flooding are limitations. Historic sites on this association would add interest to an area that could be used for recreation.

The Crete-Mayberry soil association, which dominates in the uplands in nearly half the county, is cut by many drainageways. It is intensively cultivated, and nearly 30 percent is irrigated. Habitat for bobwhite is very good; the southeastern part of Nebraska is the best quail range in the State. The northern part of this association is rated as good pheasant range, but the southern part is considered only fair. Grain sorghum, corn, and wheat provide an excellent supply of food for pheasant and bobwhite. Cottontails are abundant, particularly where woody and brushy draws dissect the area.

Topography and habitat for wildlife are varied on the gently sloping to moderately steep Morrill-Burchard soil association. The many small draws that dissect the association provide numerous odd-shaped areas that have undisturbed shrubby, grassy, and herbaceous vegetation. These areas are important to many wildlife species. The stream valleys that drain this association are generally wooded and provide habitat for squirrel, bobwhite, cottontail, deer, mourning dove, and a number of other birds and mammals.

The Geary-Hastings soil asociation is mainly in the southwestern part of the county, north of Rose Creek. A

[5] Prepared by ROBERT J. LEMAIRE, conservation biologist, and JAMES W. CARR, JR., forester, Soil Conservation Service.

large part is cultivated, but brushy draws enhance its value for wildlife, particularly for bobwhite and cottontail.

A large part of the Geary-Jansen soil association is not well suited to crops. Many odd-shaped areas are in native grass interspersed with cultivated tracts and woody draws. This mixture makes a desirable habitat for both game and nongame species of wildlife. Important game species on this association are deer, bobwhite, squirrel, cottontail, and pheasant.

The steep Benfield-Kipson soil association is mainly in the southwest corner of the county. It is mostly grassland interspersed with fingers of woodland and brush that extend into the lower parts of drainageways. Important game species are bobwhite, deer, cottontail, mourning dove, and squirrel.

The Lancaster-Hedville soil association is in the southern part of the county. Some Lancaster soils are cultivated, but the Hedville soils are predominantly in native grass. Wooded areas along some drainageways provide habitat chiefly for bobwhite and cottontail and also for deer, mourning dove, and pheasant.

Prairie chickens are an important game bird on the large areas of native grassland on the Lancaster-Hedville, Benfield-Kipson, and Geary-Jansen associations, mainly in the southeastern part of the county.

Ponds in the county are suitable only for warm-water fish, such as bluegill, bass, and catfish (fig. 20). Excessive turbidity, caused by suspended particles of clay and silt, is a major concern in many ponds, particularly if little conservation work has been done above the pond and if the watershed has clayey soils.

Wildlife is a product of soil and water. The capacity of each individual area for producing wildlife depends on the habitat provided. If grasslands are plowed and used for cultivated crops, cover is destroyed for some kinds of animals and an improved food supply is made available for others. Planting trees and shrubs in field and farmstead windbreaks and constructing farm ponds provides additional opportunities for improving habitat for wildlife. Herbaceous and woody plantings around ponds supply cover. Proper stocking and proper management can produce a sustained annual crop of fish.

Some land is better suited to wildlife than to crops. By protecting the natural cover, or by establishing a needed cover, conditions can then be improved for producing and maintaining any wildlife species.

Table 4 rates the potential of the soil associations for producing various kinds of vegetation. The ratings of *good*, *fair*, *poor* and *very poor* relate to the characteristics in each association that affect its suitability for producing the kinds of vegetation needed for wildlife habitat. Table 4 also shows the habitat needed for important game species. A rating of *high* or *medium* means that the particular vegetation is essential in the habitat of the specified game species.

***Figure 20.*—Pond in Crete-Mayberry association used for recreation and wildlife.**

TABLE 4.—*Soil associations rated for major kinds of wildlife habitat, and wildlife habitat rated for kinds of game*

Soil association	Suitability for producing—			
	Woody plants	Herbaceous plants	Grain and seed crops	Aquatic habitat
Hobbs-Hord-Cass	Good	Good	Good	Very poor.
Crete-Mayberry	Good	Good	Poor to good	(1).
Morrill-Burchard	Fair to good	Fair	Poor	Very poor.
Geary-Hastings	Fair to good	Fair to good	Fair to good	Very poor.
Benfield-Kipson	Poor	Fair	Very poor	Very poor.
Lancaster-Hedville	Poor to fair	Fair	Very poor to poor	Very poor.

Kinds of game	Wildlife habitat					
	Woody plants		Herbaceous plants		Grain and seed crops	
	Food	*Cover*	*Food*	*Cover*	*Food*	*Cover*
Pheasant	Low	High	High	High	High	High.
Bobwhite quail	Low	High	High	High	High	Low.
Deer	High	High	Medium [2]	Low	High	Low.
Waterfowl					High [3]	

[1] Fair on Butler soils, a small area of this association.
[2] Medium for white-tailed deer; high for mule deer.
[3] For dabbling ducks and geese, principally in spring and fall.

Landowners interested in wildlife can develop areas for their own use or for use by sportsmen and can often realize an economic return from such developments. Good hunting, fishing, and recreational areas are in increasing demand and justify lease payments by interested sportsmen.

Duck blinds in marshes, facilities for fishing and upland game hunting, and cabin and scenic areas are special areas of development. Small, odd-shaped or isolated areas in almost all the soil associations in the county are ideal for developing wildlife habitat. At a minimum, they can be developed for the individual landowner's enjoyment. Larger tracts suited to special hunting or other types of recreation can be used as an economic investment.

Technical assistance in planning wildlife areas, or assistance in planning and applying of conservation practices for developing outdoor recreation facilities can be obtained from the Soil Conservation Service in Fairbury, Nebraska. Additional information and assistance can be obtained from the Nebraska Game and Parks Commission, Bureau of Sport Fisheries and Wildlife, and from the Federal Extension Service.

Engineering Evaluation of the Soils [6]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important to engineers are particle size, permeability, shear strength, compressibility, compaction characteristics, and plasticity. Site conditions, such as depth to the water table, depth to sand and gravel, depth to bedrock, and topography are also important.

Data in this section can be used in determining—

1. Possible sites for industrial, commercial, residential, and recreational development.
2. Airport locations and preliminary routes for highways and underground utilities.
3. Possible sites for drainage systems, farm ponds, irrigation systems, and sewage and feedlot runoff disposal systems.
4. Sites for borrow materials for highway embankment and for highway subbase, base, and surface courses.
5. Drainage areas and volumes of surface runoff for bridge and culvert design.
6. Maintenance of structures and vegetation.
7. Detailed investigation needed at construction site.
8. Possible corrosion of underground structures.

With the soil map for identification of soil areas, the data and interpretations in tables 5, 6, and 7 can be useful for many purposes. It should be emphasized, however, that these interpretations will not eliminate the need for sampling at the site of specific engineering works involving heavy loads and excavations deeper than the depths of layers here reported. Estimates and interpretations apply to a depth of 5 feet. In approximately 90 percent of the county the soils are deep enough that bedrock does not affect their use. Hedville, Lancaster, Edalgo, Benfield, and Kipson soils have bedrock at a depth of less than 3 feet. In each mapping unit, however, are small areas of included soils.

[6] This section was prepared by JOHN E. OVERING, area engineer, ROBERT S. POLLOCK, soil scientist, and ROBERT J. FREDRICKSON, civil engineer, Soil Conservation Service, and WILLIAM J. RAMSEY, Division of Materials and Tests, Nebraska Department of Roads.

TABLE 5.—*Engineering*

[Tests performed by the Nebraska Department of Roads in accordance

Soil name and location	Parent material	Report number	Depth	Mechanical analysis [1]					
				Percentage passing sieve—					
				1½ in.	1 in.	¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
Crete silt loam: 200 feet south and 200 feet east of NW. corner of sec. 26, T. 3 N., R. 2 E. (Modal)	Loess.	S68-79	*Inches* 0-5	--------	--------	--------	--------	--------	--------
		S68-80	10-22	--------	--------	--------	--------	--------	--------
		S68-81	29-35	--------	--------	--------	--------	--------	100
		S68-82	35-72	--------	--------	--------	--------	--------	--------
Edalgo silty clay loam: 50 feet east and 150 feet south of N. quarter corner of sec. 23, T. 1 N., R. 4 E. (Modal)	Variegated clayey shales of the lower Dakota Formation.	S68-89	0-7	100	98	98	97	96	95
		S68-90	11-24	--------	--------	--------	--------	--------	100
		S68-91	[2] 28-52	--------	--------	--------	--------	100	99
Geary silty clay loam: 0.2 mile west and 50 feet north of SE. corner of sec. 31, T. 2 N., R. 1 E. (Modal)	Loveland Loess.	S68-95	0-11	--------	--------	--------	--------	--------	--------
		S68-96	15-28	--------	--------	--------	--------	100	99
		S68-97	42-54	--------	--------	--------	--------	--------	--------
Jansen loam: 0.1 mile west and 25 feet north of SE. corner of sec. 26, T. 2 N., R. 2 E. (Modal)	Loess or alluvium outwash.	S68-86	0-10	--------	--------	--------	--------	--------	100
		S68-87	13-24	--------	--------	--------	--------	100	99
		S68-88	32-40	100	98	97	95	87	67
Lancaster loam: 0.1 mile west and 50 feet south of NE. corner of sec. 22, T. 1 N., R. 1 E. (Modal)	Reworked loamy material over bedded sandstone and shale of the Dakota Formation.	S68-92	[3] 0-10	--------	--------	--------	--------	--------	100
		S68-93	10-18	--------	--------	--------	--------	--------	--------
		S68-94	26-48	--------	--------	--------	100	99	99
Mayberry silty clay loam: 0.15 mile west and 50 feet north of SE. corner of sec. 16, T. 1 N., R. 4 E. (Modal. Minimal subsoil development)	Reworked till.	S68-83	0-10	--------	--------	--------	--------	--------	--------
		S68-84	13-24	--------	--------	--------	--------	100	99
		S68-85	36-62	--------	--------	--------	--------	--------	100
Morrill clay loam: 0.3 mile south and 50 feet north of NW. corner of sec. 17, T. 3 N., R. 2 E. (Modal. Minimal subsoil development)	Reworked till.	S68-76	0-10	--------	--------	--------	--------	--------	--------
		S68-77	13-24	--------	--------	--------	--------	--------	--------
		S68-78	30-48	--------	--------	--------	--------	--------	100

[1] Mechanical analysis according to AASHO Designation T 88-57(*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser

test data

with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [1]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued			Percentage smaller than—						AASHO	Unified
No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Percent			
----	----	100	92	56	32	23	39	16	A-6(10)	CL
----	----	100	92	74	53	46	64	36	A-7-6(20)	CH
99	99	98	88	68	38	28	52	30	A-7-6(18)	CH
----	----	100	89	66	32	22	44	21	A-7-6(13)	CL
93	92	75	65	46	31	26	38	14	A-6(10)	ML-CL
98	97	88	84	73	58	52	57	32	A-7-6(19)	CH
98	98	95	88	84	69	60	53	32	A-7-6(19)	CH
----	----	99	94	57	33	27	46	20	A-7-6(13)	ML-CL
98	98	96	88	66	45	40	55	35	A-7-6(19)	CH
----	----	99	92	66	49	43	59	34	A-7-6(20)	CH
91	84	77	72	36	19	14	36	15	A-6(10)	CL
83	76	69	64	45	30	26	42	21	A-7-6(12)	CL
33	27	19	15	11	8	6	28	12	A-2-6(0)	SC
98	97	86	66	40	25	18	35	14	A-6(10)	CL
----	100	91	74	44	31	26	36	15	A-6(10)	CL
98	98	95	88	57	36	29	36	20	A-6(12)	CL
98	94	84	74	47	24	18	39	18	A-6(11)	CL
98	90	77	70	58	45	40	49	28	A-7-6(17)	CL
97	92	77	69	52	33	27	40	23	A-6(13)	CL
99	98	86	72	45	27	22	40	17	A-6(11)	CL
99	99	86	72	47	29	24	38	20	A-6(12)	CL
99	98	90	82	51	36	31	44	23	A-7-6(14)	CL

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in the table are not suitable for naming textural classes of soils.

[2] This sample represents the rock formation after preparation of laboratory samples, which may include crushing, grinding, and sieving to obtain a fine-grained soil sample. See narrative for additional description of the rock.

TABLE 6.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear in the first column of

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification	
	Seasonal high water table	Sand, mixed sand and gravel, or bedrock			Unified [1]	AASHO [1]
	Feet	*Feet*	*Inches*			
Benfield: BfB2, BfC, BfC2, BfD	(2)	1.5–3.5	0–12	Silty clay loam	CL or CH	A–7 or A–6
			12–24	Silty clay	CH or CL	A–7
			24–36	Interbedded limestone and shale.		
Burchard: BdB, BdC, BdC3, BdE	>10	>10	0–14	Clay loam	CL	A–7 or A–6
			14–32	Silty clay loam	CL or ML–CL	A–7 or A–6
			32–60	Clay loam	CL	A–7 or A–6
Butler: Bu	>10	>10	0–11	Silty loam	CL or ML	A–6 or A–4
			11–40	Clay	CH	A–7
			40–46	Silty clay loam	CL or ML–CL	A–7 or A–6
			46–60	Silt loam	CL or ML	A–6 or A–4
Cass: Cm, 2Cm	3–6	4–12	0–16	Loam	ML or CL	A–4
			16–33	Fine sandy loam	SM or ML	A–4
			33–60	Loamy sand	SM	A–2
Crete:						
Ce, CeA, CeC	[4] >10	>10	0–10	Silt loam	CL or ML	A–6 or A–4
			10–29	Silty clay	CH	A–7
			29–35	Silty clay loam	CL or CH	A–7 or A–6
			35–60	Silt loam	CL or ML	A–6 or A–4
CrB2	>10	>10	0–6	Silty clay loam	CL or ML	A–7 or A–6
			6–23	Silty clay	CH	A–7
			23–29	Silty clay loam	CL or CH	A–7 or A–6
			29–60	Silt loam	CL or ML	A–6 or A–4
Edalgo: EdB2, EdC	>10	1.5–3.5	0–11	Silty clay loam	CL or ML	A–7 or A–6
			11–28	Silty clay	CH	A–7
			28–60	Clay (shale)	CH	A–7
*Geary: GeB, GeB2, GeC, GeC3, GeE, GJC, GJC2, GJC3, GJE. For Jansen part of GJC, GJC2, GJC3, and GJE, see Jansen series.	>10	>10	0–11	Silty clay loam	CL or ML	A–7 or A–6
			11–42	Silty clay loam	CL or CH	A–7 or A–6
			42–60	Silty clay loam	CL or CH	A–7 or A–6
Gravel pits: GP. No valid estimates can be made. Onsite determination needed.						
Hastings:						
HsA, HsB, HsC	>10	>10	0–14	Silt loam	CL or ML	A–6 or A–4
			14–38	Silty clay loam	CL or CH	A–7 or A–6
			38–60	Silt loam	CL or ML	A–6 or A–4
HtB2, HtC3	>10	>10	0–5	Silty clay loam	CL or CH	A–7 or A–6
			5–29	Silty clay loam	CL or ML	A–6 or A–4
			29–60	Silt loam	CL or ML	A–6 or A–4
Hedville: HvE	[2] >10	0.5–1.5	0–8	Loam	CL or ML, SC	A–6, A–4
			8–14	Sandy loam	SM	A–2 or A–4
			14–30	Sandstone and sandy shale.		
Hobbs: 2Hb, Hb, HbA	10–20	3–20	0–26	Silt loam	CL or ML	A–4 or A–6
			26–60	Silt loam	CL or ML	A–4 or A–6
Hord: Hd, HdA	15–30	>15	0–16	Silt loam	CL or ML	A–4 or A–6
			16–60	Silt loam	CL or ML	A–4 or A–6

Footnotes at end of table.

significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions this table. The symbol > means greater than; < means less than]

Percentage of material less than 3 inches passing sieve—				Percent finer than 0.002 mm.	Permea-bility	Available water capacity	Shrink-swell potential
No. 4	No. 10	No. 40	No. 200				
					Inches per hour	*Inches per inch of soil*	
[3] 100	98–100	97–100	95–100	27–40	0. 2–0. 6	0. 21–0. 23	Moderate to high.
100	100	89–100	89–100	40–55	0. 06–0. 2	0. 11–0. 13	High to moderate.
[3] 90–100	85–100	85–100	65–98	27–38	0. 2–0. 6	0. 17–0. 19	Moderate.
100	98–100	80–100	75–100	27–40	0. 2–0. 6	0. 18–0. 20	Moderate.
90–100	85–100	80–100	65–98	27–38	0. 2–0. 6	0. 14–0. 16	Moderate.
100	100	97–100	95–100	18–27	0. 6–2. 0	0. 22–0. 24	Low.
100	100	100	98–100	40–60	0. 06–0. 2	0. 09–0. 11	Very high.
100	100	97–100	95–100	27–40	0. 2–0. 6	0. 18–0. 20	Moderate.
100	100	97–100	95–100	18–27	0. 6–2. 0	0. 20–0. 22	Low to moderate.
90–100	85–100	75–95	51–65	17–27	0. 6–2. 0	0. 20–0. 22	Low.
100	95–100	95–100	40–55	4–12	2. 0–6. 0	0. 15–0. 17	Very low to none.
100	95–100	55–75	13–30	0–10	6. 0–20. 0	0. 08–0. 10	Very low to none.
100	100	98 100	95–100	18–27	0. 6–2. 0	0. 22–0. 24	Moderate.
100	100	98–100	97–100	40–55	0. 06–0. 2	0. 11–0. 13	High.
100	100	98–100	95–100	27–40	0. 2–0. 6	0. 18–0. 20	Moderate.
100	100	98–100	95–100	20–27	0. 6–2. 0	0. 20–0. 22	Moderate.
100	100	98–100	97–100	27–38	0. 2–0. 6	0. 21–0. 23	Moderate.
100	100	98–100	97–100	40–55	0. 06–0. 2	0. 11–0. 13	High.
100	100	98–100	97–100	27–40	0. 2–0. 6	0. 18–0. 20	Moderate.
100	100	98–100	95–100	20–27	0. 6–2. 0	0. 20–0. 22	Moderate.
95–100	93–100	90–100	75–100	26–40	0. 2–0. 6	0. 21–0. 23	Moderate.
100	100	90–100	90–100	40–60	<0. 06	0. 11–0. 13	High.
100	98–100	95–100	90–100	27–36	0. 2–0. 6	0. 21–0. 23	Moderate.
100	98–100	95–100	90–100	34–40	0. 2–0. 6	0. 18–0. 20	High.
100	98–100	90–100	85–100	34–43	0. 2–0. 6	0. 18–0. 20	Moderate to high.
100	100	93–100	95–100	18–27	0. 6–2. 0	0. 22–0. 24	Moderate.
100	100	93–100	98–100	27–40	0. 2–0. 6	0. 18–0. 20	High.
100	100	93–100	95–100	18–27	0. 6–2. 0	0. 20–0. 22	Moderate.
100	100	93–100	98–100	27–40	0. 2–0. 6	0. 21–0. 23	High.
100	100	93–100	98–100	27–40	0. 6–2. 0	0. 18–0. 20	Moderate.
100	100	93–100	95–100	18–27	0. 6–2. 0	0. 20–0. 22	Moderate.
[3] 90–100	85–100	80–100	45–65	8–20	0. 6–2. 0	0. 20–0. 22	Low.
95–100	90–100	50–75	20–45	4–14	2. 0–6. 0	0. 12–0. 14	Low.
100	100	90–100	95–100	15–27	0. 6–2. 0	0. 22–0. 24	Low.
100	100	90–100	95–100	18–27	0. 6–2. 0	0. 22–0. 24	Moderate.
100	98–100	90–100	95–100	15–27	0. 6–2. 0	0. 22–0. 24	Low.
100	98–100	90–100	95–100	20–27	0. 6–2. 0	0. 20–0. 22	Moderate.

TABLE 6.—*Estimates of soil properties*

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Sand, mixed sand and gravel, or bedrock	Depth from surface (typical profile)	USDA texture	Classification: Unified [1]	Classification: AASHO [1]
	Feet	*Feet*	*Inches*			
Jansen: JaB, JaB2, JaC	>10	1.5–3.5	0–10	Loam	CL, ML	A–4 or A–6
			10–13	Clay loam	CL	A–7 or A–6
			13–32	Sandy clay loam	CL	A–6
			32–60	Sand and gravel	SP, SW	A–3 or A–2
Kipson: KsD	[2] >10	0.5–1.5	0–15	Silt loam	CL or ML	A–6 or A–4
			15–28	Interbedded limestone and shale.		
*Lancaster: LcB2, LcC, LanC3, LEE. For Edalgo part of LEE, see Edalgo series.	(1)	2–3.5	0–10	Loam	CL, ML	A–4
			10–26	Clay loam	CL	A–7 or A–6
			26–48	Sandstone and sandy shale.		
Malcolm: MnC2	>10	2–8	0–23	Silt loam	CL or ML	A–4 or A–6
			23–60	Very fine sandy loam	ML	A–4
Mayberry:						
MaaB2, MaaC	>10	>10	0–13	Silty clay loam	CL or ML–CL	A–7 or A–6
			13–42	Silty clay	CL or CH	A–7
			42–60	Silty clay loam	CL or ML	A–7 or A–6
MadC3	>10	>10	0–5	Clay	CH or CL	A–7 or A–6
			5–32	Silty clay	CH or CL	A–7 or A–6
			32–60	Silty clay loam	CL or ML	A–7 or A–6
Meadin: MwD	>10	0.5–1.5	0–5	Loam	CL, ML	A–4
			5–18	Gravelly sandy loam	SM or SC	A–2 or A–4
			18–44	Sand and gravel	SP or SP–SM	A–3 or A–1
Morrill: MrB, MrB2, MrC, MrE, MC3	>10	>10	0–42	Clay loam	CL	A–7 or A–6
			42–60	Clay loam	CL	A–7 or A–6
Rough stony land: Rv. No valid estimates can be made. Onsite determinations needed.						
Sandy alluvial land: Sx. No valid estimates can be made. Onsite determinations needed.						
Silty alluvial land: Sy. No valid estimates can be made. Onsite determinations needed.						
Wet alluvial land: Wx. No valid estimates can be made. Onsite determinations needed.						

[1] Where two or more classifications are shown, the classification listed first is the most common.
[2] Limited supply of water of high mineral content.

significant in engineering—Continued

Percentage of material less than 3 inches passing sieve— No. 4	No. 10	No. 40	No. 200	Percent finer than 0.002 mm.	Permeability	Available water capacity	Shrink-swell potential
					Inches per hour	*Inches per inch of soil*	
[3] 89–100	83–100	85–100	51–80	8–18	0. 6–2. 0	0. 20–0. 22	Moderate.
90–100	85–100	80–100	65–85	27–38	0. 6–2. 0	0. 15–0. 19	Moderate.
90–100	85–100	80–100	51–70	20–34	0. 6–2. 0	0. 15–0. 19	Moderate.
85–100	60–98	30–50	3–20	0–7	>20. 0	0. 02–0. 04	Low.
[3] 100	98–100	90–100	85–100	12–24	0. 6–2. 0	0. 22–0. 24	Low.
[3] 89–100	85–100	83–100	65–85	10–25	0. 6–2. 0	0. 20–0. 22	Low to moderate.
98–100	85–100	90–100	70–90	27–38	0. 2–0. 6	0. 15–0. 19	Moderate.
100	98–100	95–100	90–100	12–22	0. 6–2. 0	0. 22–0. 24	Low.
100	98–100	60–95	51–75	8–15	0. 6–2. 0	0. 17–0. 19	Low.
[3] 100	98–100	98–100	75–100	27–34	0. 2–0. 6	0. 21–0. 23	Moderate.
100	98–100	98–100	75–100	40–55	0. 06–0. 2	0. 11–0. 13	High.
100	98–100	95–100	75–100	27–36	0. 2–0. 6	0. 18–0. 20	Moderate.
100	98–100	98–100	75–100	40–55	0. 06–0. 2	0. 12–0. 14	High.
100	98–100	98–100	75 100	40–55	0. 06–0. 2	0. 12–0. 14	High.
100	98–100	95–100	75–100	27–36	0. 2–0. 6	0. 18–0. 20	Moderate.
[3] 90–100	85–100	80–100	51–65	7–17	0. 6–2. 0	0. 20–0. 22	Low.
85–100	90–100	45–85	10–45	4–12	6. 0–20. 0	0. 12–0. 14	Low.
90–100	80–95	40–75	3–15	0–5	>20. 0	0. 02–0. 04	Low.
[3] 100	95–100	90–100	65–90	22–36	0. 2–0. 6	0. 17–0. 19	Moderate.
100	95–100	90–100	65–90	27–40	0. 2–0. 6	0. 15–0. 19	Moderate.

[3] Less than 5 percent coarse fragments.
[4] Possibility of no available ground water in an isolated area of this soil in the west-central part of the county.

TABLE 7.—*Engineering*

An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear in the first column of this table. Absence of

Soil series and map symbols	Suitability as source of —					Soil properties affecting—	
	Topsoil	Sand or mixed sand and gravel	Road subgrade: Paved surface	Road subgrade: Gravel surface	Road fill	Highway location	Foundations
Benfield: BfB2, BfC, BfC2, BfD.	Fair	(1)	Poor	Good	Poor: less than 3 feet to bedrock.	Moderate susceptibility to frost action; 2 to 3.5 feet to bedrock; can be used for fill.	Uncompressible bedrock; possible sliding at soil-bedrock contact.
Burchard: BcB, BdC, BdC3, BdE.	Fair	(1)	Poor	Good	Fair: moderate shrink-swell potential.	High susceptibility to frost action; erodibility of slopes; compaction control needed.	Bearing capacity dependent on density and moisture; subject to frost action; moderate shrink-swell potential.
Butler: Bu	Good	(1)	Poor	Good	Fair to poor: very high shrink-swell potential.	Moderate susceptibility to frost action; surface ponding may require minimum fills; erodibility of slopes; compaction control needed.	Subject to ponding; bearing capacity dependent on density.
Cass: Cm, 2Cm	Good	Fair below 3 feet for sand.	Fair	Good to fair.	Fair to good	High susceptibility to frost action; erodibility of slopes; depth to water table may be too shallow.	Good bearing capacity if sand is confined; possible flooding and seepage; trenches may cave or slide.
Crete: Ce, CeA, CeC, CrB2.	Good; fair on eroded soils.	(1)	Poor	Good	Fair to poor: high shrink-swell potential.	Moderate susceptibility to frost action; erodibility of slopes; compaction control needed.	Bearing capacity dependent on density; possible frost action; high shrink-swell potential.

Footnotes at end of table.

interpretations

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions an entry indicates that properties are too variable for reliable estimates to be made]

Soil properties affecting—Continued						Limitation for sewage disposal	
Embankments, dikes, and levees	Pond reservoir area	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Filter fields	Sewage lagoons
Fair stability; impervious if properly compacted; limited borrow.	Moderate seepage potential where bedrock is exposed; limestone layers may be jointed.	Surface drainage may be excessive; fair to poor internal drainage; 2 to 3.5 feet to bedrock.	Low available water capacity; moderately deep over limestone and shale.	Erodibility; bedrock may be exposed in construction.	Moderate erodibility; construction can expose bedrock in places.	Severe: 2 to 3.5 feet to bedrock; low permeability; slopes.	Moderate to severe: slopes; dikes needed to provide adequate depth over bedrock.
Good stability; good workability; impervious; compaction control needed.	Low seepage	Well drained	High available water capacity; erodibility of slopes.	Erodibility of slopes.	High erodibility where subsoil is exposed; vegetation difficult to establish in places.	Severe: moderately slow permeability; slopes.	Moderate to severe: slopes; compaction needed after excavation.
Fair to good stability; impervious; compaction control needed.	Low seepage; may be suitable for dugouts.	Subject to occasional ponding; slow permeability.	High available water capacity; slow intake rate; adequate drainage essential.	Erodibility of diversion slopes.	Clayey soil that has poor workability; may have wet areas.	Moderate to severe: slow permeability; subject to ponding.	Slight: requires protection from ponding in places.
Fair stability; low permeability if compacted; can be used for dugouts in places.	High seepage potential above the water table.	Subject to occasional flooding; good internal drainage.	Moderate to low available water capacity; subject to soil blowing and water erosion.	Erodibility of diversion slopes.	Erodibility; may lack fertility.	Slight if protected from flooding; severe for possible contamination of underground water.	Moderate to severe: subject to occasional flooding; lining needed for proper functioning.
Good stability; impervious with compaction control.	Low seepage	Slow to moderate surface drainage; slow permeability.	High available water capacity; slow intake rate; slopes subject to water erosion.	Moderate erodibility of slopes.	Moderate to high erodibility; may lack fertility.	Moderate to severe: slow permeability; slopes.	Slight in less sloping areas; severe in steeper areas; compacted soil needed for cuts more than 2.5 feet in depth.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand or mixed sand and gravel	Road subgrade: Paved surface	Road subgrade: Gravel surface	Road fill	Soil properties affecting— Highway location	Foundations
Edalgo: EdB2, EdC	Fair	([1])	Poor	Good	Fair excavation and compaction control needed; test fill may be needed.	Moderate susceptibility to frost action; shrink-swell stability of cut slopes may be inadequate; compaction control needed.	Moderate susceptibility to frost action.[2]
*Geary: GeB, GeB2, GeC, GeC3, GeE, GJC, GJC2, GJC3, GJE. For Jansen parts of GJC, GJC2, GJC3, and GJE see Jansen series.	Fair; poor if slope is more than 15 percent.	Poor; fair below 10 feet for sand.	Poor	Good	Fair: moderate to high shrink-swell potential.	High susceptibility to frost action; erodibility of slopes; compaction control needed; compressible; moderate to high shrink-swell potential.	Fair bearing capacity; density variable; subject to frost action; high shrink-swell potential.
Gravel pits: Gp. No valid estimates can be made. Onsite determination needed.							
Hastings: HsA, HsB, HsC, HtB2, HtC3.	Good; fair on eroded soils.	([1])	Poor	Good	Fair: moderate shrink-swell potential.	High susceptibility to frost action; erodibility of slopes; compaction control needed; may be subject to excessive consolidation.	Bearing capacity dependent on moisture and density; subject to frost action; moderate shrink-swell potential.
Hedville: HvE	Fair; poor below 15 inches.	Fair for sand and below 3 feet if not cemented.	Fair below 3 feet, poor above.	Good to fair.	Poor: less than 1.5 feet to bedrock.[2]	Susceptible to frost action; erodibility of slopes; less than 2 feet to bedrock.[3]	Sliding is possible on soil-bedrock contact.
Hobbs: 2Hb, Hb, HbA	Good	([1])	Fair to poor.	Good to fair.	Fair: compaction control needed.	High susceptibility to frost action; flooding may require minimum fills.	Subject to consolidation when wet and under load; subject to frost action.

Footnotes at end of table.

interpretations—Continued

Soil properties affecting—Continued						Limitation for sewage disposal	
Embankments, dikes, and levees	Pond reservoir area	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Filter fields	Sewage lagoons
Fair stability; impervious if compacted; limited borrow; shale can be used for fills.	Low seepage potential.	Moderate surface drainage; very slow permeability.	Water not generally available.	High erodibility of slopes.	High erodibility; slow permeability; low fertility.	Severe: slow permeability; slopes.	Moderate: slopes.
Fair stability; impervious if compacted.	Low seepage potential unless sand is encountered.	Moderate to rapid surface drainage; moderately slow permeability.	High available water capacity; moderately slow intake rate; slopes.	Moderate erodibility of slopes.	Erodibility and lack of fertility of exposed subsoil.	Moderate to severe: moderately slow permeability; slopes.	Moderate to severe: slopes; compaction needed.
Fair stability; impervious if compacted.	Low seepage potential if soil is compacted.	Moderate to rapid surface drainage; moderately slow permeability.	High available water capacity; moderately slow intake rate; slopes erodible.	Moderately erodible slopes.	Erodibility and lack of fertility of exposed subsoil.	Moderate to severe: moderately slow permeability; slopes.	Slight to severe: slopes; sealing or lining needed.
Fair stability; moderately pervious if compacted; limited borrow above 2 feet; investigate site for bedrock borrow area.	High seepage potential where bedrock is exposed.	Rapid surface drainage; moderate permeability.	Not suited: shallow soil; slopes.	Shallowness of steep soils; low fertility.	Shallowness of soils; erodibility of slopes; lack of fertility.	Severe: shallowness to sandstone.	Severe: slopes; 1 foot to 2 feet to bedrock; variable permeability.
Fair stability; good workability; moderately pervious if compacted.	Moderate seepage potential.	Well drained; occasional overflow on 2Hb; moderate permeability.	High available water capacity; erodible on steeper slopes.	Erodibility of diversion slopes.	Moderate erodibility.	Slight if protected from overflow.	Moderate to severe: may be subject to overflow; needs sealing for proper functioning.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—					Soil properties affecting—	
	Topsoil	Sand or mixed sand and gravel	Road subgrade		Road fill	Highway location	Foundations
			Paved surface	Gravel surface			
Hord: Hd, HdA	Good	(1)	Fair to poor.	Good to fair.	Fair: compaction control needed.	High susceptibility to frost action; erodible; compaction control needed.	Subject to consolidation when wet and under load.
Jansen: JaB, JaB2, JaC.	Good	Good below 3 feet.	Fair to good.	Good to fair.	Good below 3 feet, fair above.	Susceptibility to frost action; less than 3 feet to sand and gravel; erodibility of slopes.	Good bearing capacity if sand below 3 feet is confined.
Kipson: KsD	Fair; poor below 15 feet.	(1)	Poor for surface soil; variable on rock surface.	Good	Poor: less than 1.5 feet to bedrock.	Susceptibility to frost action; less than 1.5 feet to bedrock; investigate site for borrow source.	Susceptible to frost action.[2]
*Lancaster: LcB2, LcC, LanC3, LEE. For Edalgo part of LEE; see the Edalgo series.	Good; fair on eroded soils.	Investigate site for sand below 2 feet.	Fair to poor.	Good to fair.	Poor: less than 3 feet to bedrock;[2] includes fine-grained soil, shale, sand, and sandstone.	Susceptibility to frost action; high erodibility; less than 3 feet to bedrock.	Slab-on-grade subject to frost action; seepage from surface water possible.[2]
Malcolm: MnC2	Good to fair.	Poor	Poor for surface soils; investigation is needed if subsoil is a source of borrow material.	Fair	Fair: compaction control needed.	Susceptible to frost action; high erodibility.[2]	Good bearing capacity if sandy soils are confined and maintained in dry condition.

Footnotes at end of table.

interpretations—Continued

Soil properties affecting—Continued						Limitation for sewage disposal	
Embankments, dikes, and levees	Pond reservoir area	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Filter fields	Sewage lagoons
Fair stability; good workability; moderately pervious if compacted.	Moderate seepage potential.	Slow to moderate surface drainage; moderate permeability.	High available water capacity; erodible on steeper slopes.	Erodibility of diversion slopes.	Moderate erodibility.	Slight	Slight for compacted soils.
Fair stability; impervious if borrow and compaction is controlled.	High seepage potential below 3 feet.	Moderate surface drainage; moderate permeability in subsoil and very rapid permeability in underlying material.	Moderate available water capacity; erodible on steeper slopes.	High erodibility.	High erodibility; droughty; fertility may be low.	Slight below 3 feet if no possibility of contaminating the underground water; moderate on slopes.	Severe: slopes; moderate permeability in subsoil and very rapid permeability in underlying material; diking for depth and sealing are needed for proper functioning.
Fair stability; fair workability; limited borrow.	High seepage potential where bedrock is near surface.	Rapid surface drainage; moderate permeability.	Not suited: shallow soils on slopes.	Shallowness of steep soils.	High erodibility; shallowness of steep soils.	Severe: shallow to bedrock.	Severe: slopes; ½ foot to 1½ feet to bedrock.
Fair stability; moderately pervious if compacted; limited borrow material.	High seepage potential where bedrock is exposed.	Moderate to rapid surface drainage; moderate permeability.	Water generally not available.	High erodibility; bedrock; low fertility.	High erodibility; fertility may be low; bedrock.	Moderate to severe on slopes; trench in weathered sand possible if no contamination of underground water.	Moderate to severe: slopes; slight for all construction in fine-grained soils.
Fair stability; impervious if compacted.	High seepage potential.	Moderate surface drainage; moderate permeability.	Water generally not available.	High erodibility; low fertility in cut sections.	High erodibility; fertility may be low.	Moderate to severe: slopes; slight if contamination of underground water is not possible.	Moderate to severe: slopes; moderate permeability; dikes and sealing or lining needed for proper functioning.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—					Soil properties affecting—	
	Topsoil	Sand or mixed sand and gravel	Road subgrade		Road fill	Highway location	Foundations
			Paved surface	Gravel surface			
Mayberry: MaaB2, MaaC, MadC3.	Fair; poor on eroded soils.	(1)	Poor	Good	Fair: compaction control needed; moderate to high shrink-swell potential.	Susceptible to frost action; erodibility of slopes; subgrade subject to shrink-swell.	Fair bearing capacity; subject to frost action; moderate to high shrink-swell potential.
Meadin: MwD	Poor	Sand and minor amount of gravel below 1 foot to 3 feet.	Good below ½ foot to 1½ feet.	Fair to poor.	Good below ½ foot to 1½ feet: slopes erodible.	Low susceptibility to frost action; less than ½ foot to 1½ feet to sand and gravel; susceptibility to soil blowing and water erosion.	Good bearing capacity if confined; good drainage for walls; subject to caving in cuts.
Morrill: MC3, MrB, MrB2, MrC, MrE.	Good; fair on eroded soils.	(1)	Poor	Good	Fair: compaction control needed.	Susceptible to frost action; erodibility of slopes; cut slopes should be investigated for stability.	Fair to good bearing capacity; permeability may require wall drainage.
Rough stony land: Rv. No valid estimates can be made. Onsite determination needed.							
Sandy alluvial land: Sx. No valid estimates can be made. Onsite determination needed.							
Silty alluvial land: Sy. No valid estimates can be made. Onsite determination needed.							
Wet alluvial land: Wx. No valid estimates can be made. Onsite determination needed.							

[1] Sand and gravel generally are not available.

interpretations—Continued

Soil properties affecting—Continued						Limitation for sewage disposal	
Embankments, dikes, and levees	Pond reservoir area	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Filter fields	Sewage lagoons
Good stability; impervious if compacted.	Low seepage potential.	Moderate surface drainage; slow permeability.	Moderate to high available water capacity; slow intake rate; erodibility of steeper slopes.	High erodibility of slopes.	High erodibility; droughty; fertility may be low.	Severe: slow permeability; slopes.	Moderate to severe: slopes; compaction control needed for dikes.
Fair stability; pervious in cleanest sands.	High seepage potential.	Moderate to rapid surface drainage; moderately rapid to very rapid permeability.	Not suited: slopes; shallowness of soil.	Shallowness of steep soils over sand and gravel.	High erodibility; low fertility; droughty.	Slight to severe: contamination of underground water possible; slopes.	Severe: slopes, rapid permeability; impervious membrane and diking needed on flatter slopes; not feasible on steeper slopes.
Good stability; impervious if properly compacted.	Low to moderate seepage potential unless sand is encountered.	Moderate to rapid surface drainage; moderately slow permeability.	High available water capacity; erodibility of steeper slopes.	Erodibility____	Erodibility____	Moderate to severe: slopes; permeability.	Moderate to severe: slopes.

[2] Onsite investigation is needed if bedrock is to be used as a source of borrow or fill material or as support for structures.

Some terms have a special meaning in soil science that may be familiar to engineers. These terms are defined in the Glossary. Engineering terminology is explained under "Engineering Classification Systems" and "Engineering Interpretations of Soils."

Engineering classification systems

The two systems most commonly used in classifying soils for engineering are the system approved by the American Association of State Highway Officials (AASHO) and the Unified system.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction. In this system all soil material is classified in seven principal groups on the basis of field performance. The groups range from A–1, which consists of soils that have the highest bearing strength and the best soils for subgrade, to A–7, which consists of soils that have the lowest strength when wet. Soils in groups A–1, A–2, and A–3 are mostly sand and gravel mixtures. Those in groups A–4 through A–7 are mostly silt-clay mixtures. A sand-silt-clay soil is further classified by identifying the silt-clay part. An A–2–4 soil, for example, is an A–2 sand that has an A–4 type silt-clay mixture. Within each group, the relative engineering value of the soil material is indicated by a group index number. The numbers range from 0, for the best material, to 20, for the poorest. The group index number is shown in parentheses following the soil group system (see table 5).

The Nebraska Department of Roads uses a group index of −4 to 32 instead of 0 to 20. This enlarged group index bracket allows evaluation of the plastic and nonplastic fine-grained soil material in sand and determination of the effect of a high clay content, for which the group index is greater than 20.

In the Unified system (*10*) soils are classified according to their texture and plasticity and their performance as engineering construction material. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. GP and GW are clean gravels, and GM and GC are gravels that include, respectively, an appreciable amount of nonplastic and plastic fines. SP and SW are clean sands. SM and SC are sands that include fines of silt and clay. ML and CL are silts and clays that have a low liquid limit, and MH and CL are silts and clays that have a high liquid limit. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

Soil scientists use the USDA textural classification (*6*). In this, the texture of the soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter, that is, the proportion of sand, silt, and clay. Textural modifiers, such as gravelly, stony, shaly, and cobbly, are used as needed.

Table 5 shows the AASHO and Unified classification of specified soils in the county, as determined by laboratory tests. Table 6 shows the estimated classification of all the soils in the county according to all three systems of classification.

Many organizations, including the Soil Conservation Service, U.S. Bureau of Reclamation, Corps of Engineers, and other engineers, use the Unified system (*10*). Soils are classified generally as coarse-grained, fine-grained, and organic or peat. Fine-grained soils are classified according to plasticity characteristics. Coarse-grained soils are classified primarily according to gradation, and organic soils are classified according to odor and plasticity change after ovendrying.

Combinations of letters are used to identify soil materials and certain properties in the Unified system. G is used for gravel, S for sand, C for clay, M for silt, W for well-graded, P for poorly graded, L for liquid limit, and H for high liquid limit.

Two letters are combined to classify the soil; for example: SP is a sand, poorly graded; CL is a clay of low liquid limit; and GC is a gravel-clay mixture. There are twelve possible inorganic classifications, and three possible organic classifications. Organic soils, OL and OH, and peat soils. Pt, are uncommon in Nebraska.

In tables 5 and 6, the soils of Jefferson County are classified as SP, SW, SP–SM, SP–SC, SM, SC, ML, ML–CL, CL, and CH. Soils that have borderline characteristics of two classifications are given a dual classification, for example ML–CL.

Engineering test data

Table 5 shows engineering test data on 22 soil samples taken from seven soil series. The soils tested represent some of the most extensive soils in Jefferson County, about 75 percent of the county. Samples representing the Burchard, Butler, Cass, Hastings, and Meadin series obtained in nearby counties have also been tested. Data on those soils, published in soil surveys for other Nebraska counties, represent the same soils in Jefferson County. The tests were made by the Division of Materials and Tests, Nebraska Department of Roads, according to standard procedures of the American Association of State Highway Officials.

Each soil listed in table 5 was sampled at only one location, and the data shown apply only to that particular location. From one location to another, a soil can differ considerably in characteristics that affect engineering. Even where soils are sampled at more than one location, test data probably do not show the widest range in characteristics.

The mechanical analysis was made by a combination of the sieve and hydrometer methods.

Tests for liquid limit and plastic limit measure the effect of water on the consistency of the soil material. As the moisture content of a clay soil is increased from a dry condition, the soil changes from a solid to a plastic state and then to a liquid state. The *plastic limit* is that moisture content, expressed as a percentage of the ovendry weight of the soil, at which the soil passes from a solid to a plastic state. The *liquid limit* is that moisture content at which the soil passes from a plastic to a liquid state. The *plasticity index* is the numerical difference in percent moisture between the liquid limit and the plastic limit. It indicates a range of moisture content within which soil is considered to be plastic. Some silty and sandy soils are nonplastic, which means they will not become plastic at any moisture content.

The engineering classifications in the last two columns of table 5 are based on data obtained by mechanical analysis and on tests to determine the liquid limit and plastic limit.

Engineering properties of soils

In table 6 are estimates of the soil properties significant in engineering. The estimates are based on the engineering test data in table 5 and on other information obtained in the county during the survey. For detailed information about the soils and the kind of underlying bedrock, refer to the section "Descriptions of the Soils." For information about geology, refer to the section "Formation and Classification of the Soils."

Table 6 shows the textural classification used by the United States Department of Agriculture and the AASHO and Unified engineering classifications. Estimates of the percentages of material passing the numbers 4, 10, 40, and 200 sieves, and the percentage finer than 0.002 millimeter, were determined by the hydrometer method. Estimates of the percentage passing the sieves are based on the assumption that material up to and including 3 inches in diameter equals 100 percent. Several soils in Jefferson County have bedrock close to the surface. Rock fragments of varying sizes occur in places in these soils.

In the AASHO and Unified systems, soil particles retained on the number 200 sieve are classified as sand and gravel. Silt and clay particles pass through this sieve. Particles retained on the No. 4 sieve are classified as gravel. The range of values shown in table 6 for the percentage of soil particles finer than 0.002 millimeter represent the estimated clay fraction of the soil. Silt and clay particles affect such properties as shear strength, permeability, compaction, and shrink-swell potential.

In tables 5 and 6 the clay percentage is based on analysis by the hydrometer method (AASHO Designation T–88). Results obtained by this method differ slightly from those obtained by the pipette method used by SCS soil scientists in standard soil survey procedures.

Permeability refers to the rate at which water moves through a saturated soil. It depends largely on gradation, structure, and density. The rate is shown in inches of water per hour. Terms used to describe permeability and the equivalent rates are given in the Glossary.

Available water capacity, estimated in inches of water per inch of soil depth, is the capacity of the soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of water at field capacity and the amount at wilting point.

A generalized rating for shrink-swell potential is given in table 6. Several soils, such as those in the Hastings, Mayberry, and Crete series, have moderate to high shrink-swell potential. Generally, soils that have a high content of expandable clay, such as montmorillonite, undergo a volume change if the soil moisture is changed. Clean sands and gravels undergo little or no volume change if wetting or drying occurs.

Soil dispersion is not a serious concern because few areas contain enough salts to produce moderate dispersion. Salinity is generally not a problem, but in some small areas the somewhat poorly drained soils on bottom land along the Little Blue River are saline. These areas are shown on the detailed soil map by a saline spot symbol. Onsite investigation is needed in such areas because salinity is a hazard to construction work.

Reaction in a soil is the degree of acidity or alkalinity, expressed as a pH value. A pH value of 7.0 is precisely neutral, a lower pH value indicates that the soil is acid, and a pH value higher than 7.0 indicates that the soil is alkaline. The potential corrosive hazard to metal structures must be considered on all soil material that has an approximate pH value higher than 7.8 or less than 6.3. Reaction is shown in the description of the profile representative of the series following each soil series description under the heading "Descriptions of the Soils."

Engineering interpretations of soils

Table 7 is a guide in planning and in further investigation of soils to be used in engineering structures. Onsite determination of the soils for type, quantity, and engineering properties is important.

Topsoil is rated *good*, *fair*, or *poor*, depending on depth, fertility, organic-matter content, erodibility, workability, and quantity. It is used on road and dam embankments, excavated slopes, and gardens and lawns.

Several soils in Jefferson County, for example, Meadin and Jansen soils, are sources of sand and gravel. Exploration is needed to determine depth to the sand and gravel and the quantity and gradation of the material. Operational sandpits are a guide in locating sources of sand and gravel.

Sands and gravels are rated *good* to *fair* for subgrades under pavement and *poor* for subgrades under gravel. Silt and clay on the road subgrade surface are more stable for gravel surfacing. Thus, for paved roads, soils classified A–1 and A–3 are rated *good;* A–2, *good to fair;* A–4, *fair* to *poor*. For most soils the road subgrade, or foundation, and road fill have the same classification for paved roads because the engineering requirements are approximately the same.

Ratings for use as road fill include suitability as embankment material, suitability as a foundation for embankments, erodibility of cut and filled slopes, and potential frost action.

Highway locations are rated according to susceptibility to frost heave, shrink-swell potential, erodibility of cut and fill slopes, possibility of flooding, and depth to the water table. Frost action is caused by the expansion of freezing water in silt-clay soils, which in turn, increases maintenance of paved roads. A high water table can contribute to the susceptibility of a soil to frost action or frost heave.

Foundations generally are rated on bearing, or load-carrying, capacity. Most soils have a high bearing capacity when dry. Some of the windblown soils are subject to high consolidation if saturated under load. Sands and gravels have high bearing capacity if confined. Specific values for bearing capacity, for example, pounds per square inch, should not be assigned to estimated values as expressed in words in table 7. Depth to the water table should be determined in selecting a building site because wetness is a hazard to foundations. The shrink-swell potential also affects foundations. The possibility of seepage into foundations or excavations is indicated in table 7.

527-044—75——5

Embankments are subject to seepage and compressibility. The term "workability" in this column refers to the hauling and compaction characteristics of the soil. Potential seepage depends on moisture, gradation, and compaction of the fill. Erodibility of fill slopes is also indicated. Two methods of compaction testing are used for soils in Jefferson County. Soils that are approximately 15 percent or less silt and clay particles should be compacted according to the relative density test. In this test vibratory, instead of sheepsfoot rollers, are used. Soils that are approximately 15 percent or more silt and clay particles are generally compacted under sheepsfoot, or tamping, rollers and moisture is controlled at or above a minimum limit. See table 5 for test results giving maximum dry densities for particular samples.

Dikes and levees are used to control surface water. They are subject to soil blowing, water erosion, and horizontal seepage unless properly compacted. Some soils are subject to shrinkage and cracking as they dry. Slopes in dikes and levees constructed with sandy soils must be gentle and smooth for stability. Slopes can be steeper in dikes and levees constructed with clay soil, because the fill is relatively impervious to water and is stable if wet.

Potential seepage is also a hazard to pond reservoirs. A high water table indicates the possibility of excavating a dugout for a water supply. A low, or deep, water table can indicate the need for sealing or lining a pond; it also indicates that construction of a fill may be easier because the foundation is drier.

Agricultural drainage depends on the depth to the water table, available outlets, and permeability of the various soil layers.

Suitability of soils for irrigation is affected by such factors as available water capacity, permeability, surface intake rate, steepness of slopes, and possible limiting depths of leveling cuts.[7] The ratings for available water capacity are limited to the top 5 feet of soil. The rating is *high* if the soil holds more than 9 inches of water, *moderate* if it holds 6 to 9 inches, *low* if it holds 3 to 6 inches, and *very low* if it holds less than 3 inches. Intake rate is the rate at which water moves into the soil. The intake rate is affected by time, properties of the surface horizon, and permeability of the various soil layers. The intake rate is *rapid* if the soil takes in more than 2 inches of water per hour, *moderate* if 0.5 inch to 2 inches, and *slow* if less than 0.5 inch.

The possible hazards of soil blowing and water erosion, the difficulty of establishing vegetation, and soil fertility all affect the use of the soils for terraces, diversions, and grassed waterways. The cost of maintaining terraces and diversions is greater if siltation from higher elevations occurs. Depth to erodible stands limits the depth of cuts for diversion alinement. Rough topography and steep slopes affect terrace and diversion alinement.

Limitations of the soils for use as sewage filter fields and sewage lagoons are shown in table 7. Use of soils for sewage disposal can also be related to the soil classification, the permeability values, and the available water capacity values shown in table 6. For filter fields, the limitation is *slight* if infiltration is good and underground water is not contaminated, *moderate* if the soil is finer grained and has a lower intake rate, and *severe* if the water table is high or the soil is impervious.

[7] For further information on irrigation, see UNITED STATES DEPARTMENT OF AGRICULTURE, IRRIGATION GUIDE FOR NEBRASKA. 1971.

For sewage lagoons, water must be retained in the lagoon before aerobic decomposition of the fresh sewage can occur. Thus, an impervious soil is desirable for constructing this facility. The need for sealing with bentonite or sodium carbonate or lining with plastic or rubber is indicated. Some soils can be reworked and compacted to provide a liner. Sandy material that has a high water table is the least desirable material for constructing a sewage lagoon and is rated severe.

Both sewage filter fields and disposal lagoons should be located so as not to contaminate wells that furnish a domestic water supply or stockwater. Other factors, such as steepness and possibility of flooding, should also be considered in sewage treatment design.

Some soils in Jefferson County, for example, Benfield, Hedville, Lancaster and Kipson soils, are only shallow or moderately deep over bedrock. The rock may have a general name such as limestone, sandstone, or shale. A geologist can provide the specific formation name in which it is located.

If bedrock is excavated for some purpose, the rock is generally broken into fragments small enough to be used as fill. The rock can be placed in highway fills and in both the upstream and downstream slopes of dams (*3*). Using excavated rock in an embankment is generally more economical than securing additional borrow material from another source.

Bedrock in Jefferson County is easily ripped. Medium to heavy equipment is needed. Little or no ripping or breaking is needed on most of the shales and sandstones.

Formation and Classification of the Soils

The pages that follow describe the major factors of soil formation and explain how these factors have affected the soils in Jefferson County. They also define the system of soil classification currently used and classify each soil series according to that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineral composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and

plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

The soils of Jefferson County formed in alluvium, loess, water-deposited sand and gravel, reworked glacial till, and residuum weathered from limestone, sandstone, and shale. The parent materials are shown in figure 21.[8] This diagram also shows the relationship of soils to the physiography and topography of the county.

The principal parent material is Peoria Loess, which consists of light brownish-gray or gray to yellowish-brown silty material transported by wind. This material ranges from a few feet to as much as 25 feet in thickness. The soils that formed in this material are well drained to somewhat poorly drained. They have distinct horizons, which indicates that soil forming processes have been active over a long period. Hastings soils, for example, are well drained and have a gray or dark-gray, friable surface layer and a grayish-brown or dark grayish-brown silty clay loam subsoil. Crete soils have a grayish-brown or dark grayish-brown, moderately to strongly compact silty clay or clay subsoil. Butler soils, which are in depressions on uplands, are somewhat poorly drained and have a gray, leached, friable surface layer and a gray, strongly compact clayey subsoil.

Loveland Loess is also in the county. It is older than the Peoria Loess and is more strongly oxidized, as evidenced by its reddish color. It is generally covered by Peoria Loess, but is at the surface on the lower slopes along many intermittent drainageways in the western part of the county. Geary soils formed in Loveland Loess. They are similar to Hastings soils, but have a reddish-brown subsoil.

Water-deposited sand and gravel of Pleistocene age is on valley sides of the Little Blue River and along its larger entrenched tributaries. Jansen and Meadin soils formed in Peoria Loess and Loveland Loess overlying and mixed with this sand and gravel. On sites where 20 to 40 inches of loess or loess-sand material overlies the sand and gravel, the moderately deep Jansen soils are dominant. On sites where 10 to 20 inches of loess or loess-sand material overlies the sand and gravel, the shallow Meadin soils are dominant. In uneroded areas all of these soils contain enough organic matter to have a grayish-brown or dark grayish-brown loam surface layer. Their subsoil is loam or clay loam that has a pronounced reddish tinge.

Recently deposited alluvium is on stream terraces and bottom lands along the major drainageways. It consists of sediment washed from the uplands onto the flood plains. Soil formation is slight in the alluvial sediment, and the texture of the subsoil is closely related to the texture of the parent material and substratum. On sites that have 40 inches or more of silty alluvium, Hobbs and Hord soils are dominant. On sites that have 40 inches or more of sandy loam alluvium, Cass soils are dominant. Alluvial land types are on sites where the alluvial sediment is recently deposited, stratified sand and silt. These sites are subject to frequent flooding and are poorly drained in places. Texture varies within short distances. The alluvial sediment has a high content of organic matter and has retained the dark color of the upland soils from which it was derived.

Mayberry and Morrill soils formed in reworked loess and till. Burchard soils formed in till. These types of parent material are most common on the lower slopes of the intermittent drainageways in the eastern half of the county. Mayberry, Morrill, and Burchard soils are deep and have a surface layer of grayish-brown or dark grayish-brown silty clay loam or clay loam. The subsoil of the Mayberry soils is reddish-brown silty clay. The subsoil of the Burchard and Morrill soils is dark-gray or pale-brown clay loam or silty clay loam. All of these soils have a few large boulders on the surface and small stones or pebbles throughout their profiles.

Kipson and Benfield soils formed in limestone residuum. In this county the limestone residuum is mostly weathered from Greenhorn Limestone, which is underlain by Graneros Shale. In some areas the weathered material contains thin deposits of loess. Greenhorn Limestone consists of thin strata of medium-soft limestone interbedded with gray shale. Graneros Shale consists of dark-gray shale that has thin calcareous layers. On sites where about 10 to 20 inches of weathered material overlies limestone, the shallow Kipson soils are dominant. On sites where 20 to 10 inches or more of weathered material overlies limestone, the moderately deep Benfield soils are dominant.

Hedville, Lancaster, and Edalgo soils formed in residuum of the Dakota Formation, which underlies Graneros Shale and consists of sandstone, shale, and variegated clay. The Dakota Sandstone is stratified, consolidated and unconsolidated sand interbedded with shale. On sites where about 10 to 20 inches of loamy material overlies sandstone, the shallow Hedville soils are dominant. On sites where 20 to 40 inches or more of loamy or clay loam material overlies sandstone, the moderately deep Lancaster soils are dominant. On sites that are dominantly weathered shale and 20 to 40 inches or more of silty clay residuum, Edalgo soils are dominant. Rough stony land consists of areas of steep, irregularly shaped slopes that have numerous outcrops of limestone, sandstone, and shale.

Climate

Climate directly affects the weathering and reworking of parent material through rainfall, temperature, and wind. Water received as rainfall moves through the drainageways, continually shifting, sorting, and reworking unconsolidated material of all kinds. This sediment

[8] Adopted from the map of Isometric Fence Diagram showing Geology, Water Table, and Hydrochemical Facies: Maurice D. Veatch, Conservation and Survey Division, University of Nebraska.

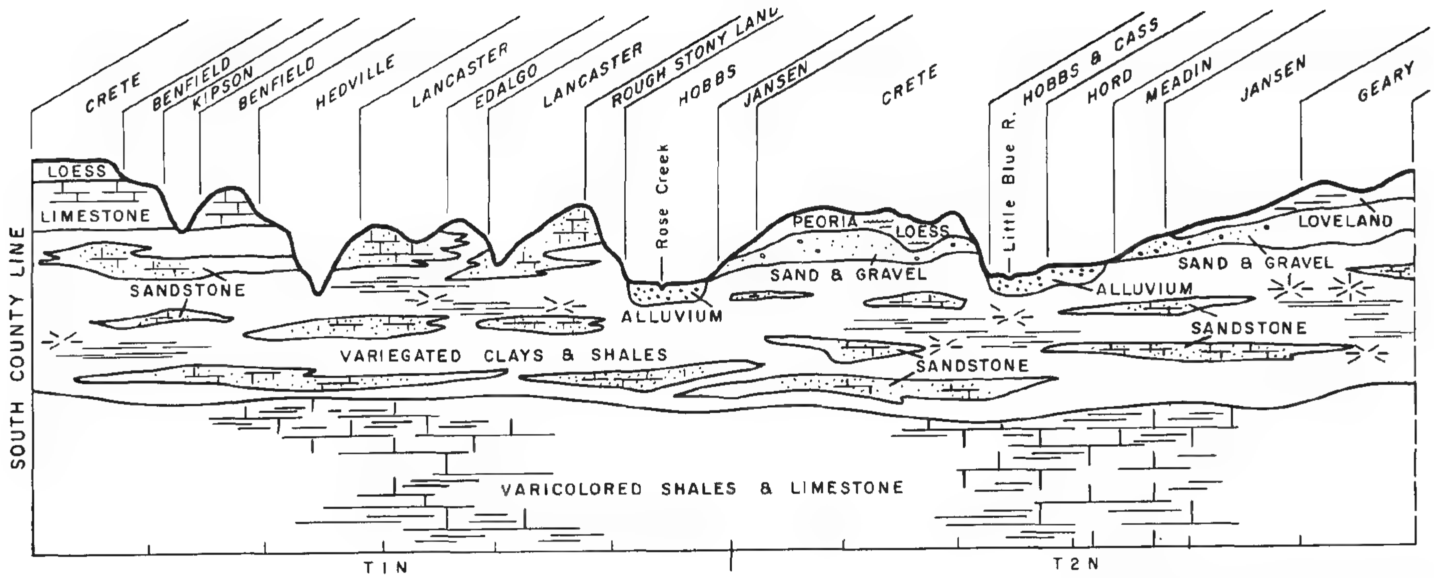


Figure 21.—South-to-north geological

is deposited, picked up, and redeposited many times by flowing streams. The alluvial soils in this county are examples of soils formed in water-deposited sediment. Moisture enters the soil and moves through it to remove the free lime from the surface layer and the subsoil. Where water has moved colloids from the upper layer to the lower layer a claypan has formed. Alternate freezing and thawing hastens mechanical weathering of parent material. Summer heat and humidity speeds chemical weathering. The residual soils derived from limestone and sandstone are examples of soils that formed through mechanical and chemical weathering. Wind transfers soil material from one place to another. The extensive deposits of loess in this county are examples of the importance of wind as an agent of deposition of soil material.

Climate affects the soils indirectly through the kind and extent of vegetative cover and the kind of animal life that can be sustained. The primary source of the organic matter in a soil is vegetation. Animals that live in the soil help in converting dead leaves, stems, roots, and other plant remains to usable organic matter. Burrowing animals help in mixing the various layers of soil.

The climate of Jefferson County is characterized by a moderately long and cold winter, a cool spring and considerable precipitation, a warm summer and many thunderstorms, and a mild autumn and occasional rainy periods. The climate is fairly uniform throughout the county, and differences in the soils cannot be attributed to differences in climate. There are wide seasonal variations in temperature, as well as wide variations in the amount of rainfall. The temperature often falls below 0°F. in winter and rises to nearly 100° in summer. The annual average precipitation is about 29 inches, and the average temperature is 25° in winter and 78° in summer.

Plant and animal life

The native plants in Jefferson County were mainly tall, mid, and short grasses. Trees grew along the streams in narrow bands. Aquatic plants were abundant in the low, wet areas along the Little Blue River near Crystal Springs and along Big Sandy Creek near Alexandria Lakes. Plants supplied an abundance of organic matter which affected the physical and chemical properties of the soil. All soils in Jefferson County formed under native grass. All have a friable, dark-colored surface layer.

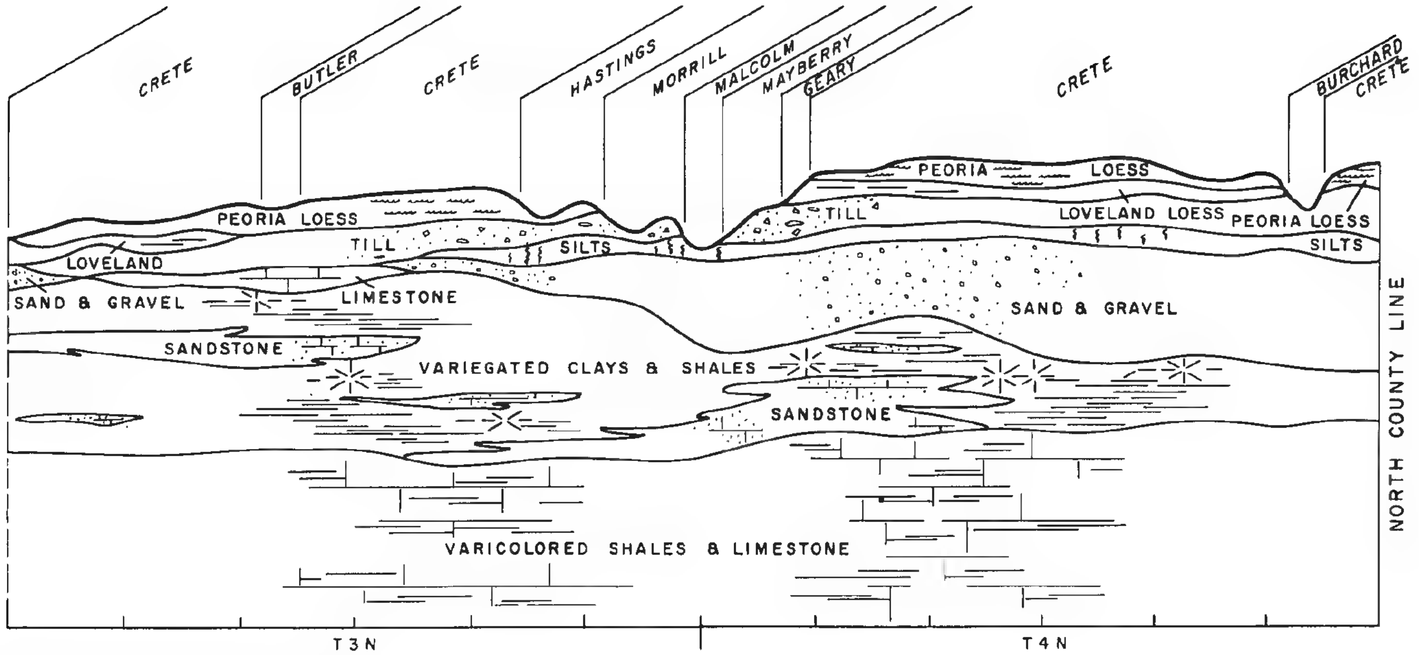
The fibrous roots of native grasses penetrated the soil bringing up plant nutrients and moisture for growth. The plant roots made the soil more porous and when they died, supplied organic matter to be decomposed and used again by other plants. When the tops of the plants died, organic matter was deposited on the surface and was eventually worked into the surface layer of the soils.

Animal life in the soil transforms organic matter to humus, transforms nitrogen from the air to a form usable by plants, and mixes the soil and moves it from place to place. Soil micro-organisms, such as bacteria, fungi, and worms, all help in changing organic matter to a form that is used as food for themselves and plants. Earthworms digest organic matter and mix it with soil particles. Burrowing animals and earthworms mix soil materials and provide openings for air and water to enter and move through the soil.

Man's activities, particularly in altering drainage conditions, maintaining fertility, and changing the kinds of vegetation, will have an important effect upon both the rate and direction of soil formation in the future.

Relief and drainage

A wide range in relief and natural drainage is characteristic of Jefferson County.



profile across central Jefferson County.

Relief, or lay of the land, affects runoff, drainage, and water erosion. Runoff is very rapid on the steep slopes in the southern part of the county. Little rainfall soaks into the soil. Consequently, the steeper soils have less distinct horizons than the less sloping soils, a thinner solum, and a lighter colored surface layer. Less moisture is available for plant growth and microbiological activity in the steeper soils. Soil horizons are indistinct and thin in the shallow Kipson and Hedville soils, for example. Lime is not leached deeply in steep soils, such as Burchard clay loam, 11 to 30 percent slopes.

Generally, nearly level soils have a thick surface layer and subsoil. Much of the rainfall soaks into these soils, increasing plant growth, biological activity, and the rate of soil formation. The subsoil is thicker and finer textured in Crete silt loam, 0 to 1 percent slopes, for example, than in Hastings silt loam, 7 to 11 percent slopes.

Soils in depressions, such as Butler silt loam, are somewhat poorly drained and have a clayey subsoil that shows evidence of strong profile development.

Soils on bottom lands at the lower elevations are subject to overflow for short periods. Additional soil material and debris are deposited by each overflow. Decay of organic matter is slower in these soils than in well-drained soils. Hobbs and Cass soils are subject to overflow.

Time

The time required for a soil to form depends largely on the parent material. The finer the texture of the parent material the longer the time needed for soil formation. The finer textures retard the downward movement of water, which is necessary in the process of soil formation. Some acid soils in the more humid regions form in a short time. A long time, however, is needed for soils that form in material weathered from exposed limestone.

The youngest soils in Jefferson County formed in recently deposited alluvium. They have little or no horizon development because they have been in place for only a short time. Hobbs and Cass soils and Silty alluvial land are examples of young soils. Soils that formed in alluvium on the higher stream terraces are intermediate in age. They have horizons in the beginning stages of development. Hord soils are in this category.

The oldest soils of the county are on uplands and have been in place long enough to develop genetic horizons that are fairly thick. The texture of the subsoil is finer than that of the parent material. Hastings, Crete, and Mayberry are examples of these soils. Some soils formed in material weathered from bedrock. Benfield, Lancaster, and Kipson are examples of these soils.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 and revised later. The system currently used by the National Cooperative Soil Survey was de-

veloped in the early sixties (*4*) and was adopted in 1965 (*7*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series of Jefferson County by family, subgroup, and order, according to the current system, as of May, 1973.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different kinds of climate. Table 8 shows that Mollisols is the only soil order in Jefferson County.

Mollisols formed under grass and have a thick, dark-colored surface horizon containing colloids dominated by bivalent cations. The soil material in these soils has not been mixed by shrinking and swelling.

SUBORDER.—Each order is divided into suborders, primarily on the basis of the characteristics that seemed to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, and major differences in chemical composition, mainly calcium, magnesium, sodium, and potassium. The great group is not shown separately in table 8. The last word in the name of the subgroup designates the great group.

SUBGROUP.—Each great group is divided into subgroups, one representing the central or typic, segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. Subgroups are designated by placing one or more adjectives before the name of the great group.

FAMILY.—Families are established within a subgroup primarily on the basis of the properties important to the growth of plants or the behavior of soils when used for engineering. Among the properties considered are texture, mineral content, reaction, soil temperature, permeability, thickness of horizons, and consistence.

TABLE 8.—*Soils classified according to the current system of classification*

Series	Family	Subgroup	Order
Benfield	Fine, mixed, mesic	Udic Argiustolls	Mollisols.
Burchard [1]	Fine-loamy, mixed, mesic	Udic Argiustolls	Mollisols.
Butler	Fine, montmorillonitic, mesic	Abruptic Argiaquolls	Mollisols.
Cass	Coarse-loamy, mixed, mesic	Fluventic Haplustolls	Mollisols.
Crete	Fine, montmorillonitic, mesic	Pachic Argiustolls	Mollisols.
Edalgo	Fine, mixed, mesic	Udic Argiustolls	Mollisols.
Geary [2]	Fine-silty, mixed, mesic	Udic Argiustolls	Mollisols.
Hastings [3]	Fine, montmorillonitic, mesic	Udic Argiustolls	Mollisols.
Hedville	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Hobbs	Fine-silty, mixed, mesic	Cumulic Haplustolls	Mollisols.
Hord	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols.
Jansen [4]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Udic Argiustolls	Mollisols.
Kipson	Loamy, mixed, mesic, shallow	Udorthentic Haplustolls	Mollisols.
Lancaster [5]	Fine-loamy, mixed, mesic	Udic Argiustolls	Mollisols.
Malcolm	Coarse-silty, mixed, mesic	Typic Hapludolls	Mollisols.
Mayberry [6]	Fine, montmorillonitic, mesic	Aquic Argiudolls	Mollisols.
Meadin	Sandy-skeletal, mixed, mesic	Udarthentic Haplustolls	Mollisols.
Morrill [7]	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.

[1] Burchard clay loam, 7 to 11 percent slopes, severely eroded (BdC3) is a taxadjunct to the Burchard series. It has a lighter colored surface layer than is defined as the range for the series.

[2] Geary silty clay loam, 3 to 11 percent slopes (GeC3) and the Geary soil in Geary and Jansen soils, 5 to 11 percent slopes, severely eroded (GJC3) are taxadjuncts to the Geary series. They are lighter colored than is defined as the range for the series.

[3] Hastings silty clay loam, 3 to 11 percent slopes, severely eroded (HtC3) is a taxadjunct to the Hastings series. It has a lighter colored surface layer than is defined as the range for the series.

[4] Jansen soil in Geary and Jansen soils, 5 to 11 percent slopes, severely eroded (GJC3) is a taxadjunct to the Jansen series. It has a lighter colored surface layer than is defined as the range for the series.

[5] Lancaster soils, 7 to 11 percent slopes, severely eroded (LanC3) are taxadjuncts to the Lancaster series. They have a lighter colored surface layer than is defined as the range for the series.

[6] Mayberry clay, 3 to 11 percent slopes, severely eroded (MadC3) is a taxadjunct to the Lancaster series. It has a lighter colored and more clayey surface layer than is defined as the range for the series.

[7] Morrill soils, 3 to 11 percent slopes, severely eroded (MC3) are taxadjuncts to the Morrill series. They have a lighter colored surface layer than is defined as the range for the series.

SERIES.—The series is a group of soils having major horizons that, except for texture of the surface layer, are similar in important characteristics and in their arrangement within the profile.

Mechanical and chemical analysis

Much data on mechanical and chemical properties of soils can be obtained by analysis of the soils in a laboratory. This information is useful to soil scientists in classifying soils and in developing concepts of soil genesis. It is also helpful in estimating available water capacity, soil blowing, fertility, tilth, and other practical aspects of soil management. Data on reaction, electrical conductivity, and percentage of exchangeable sodium help in evaluating the need for lime and fertilizers.

Useful data on soils that are in Jefferson County, but were sampled in nearby counties, are recorded in Soil Survey Investigations Report Number 5 (*9*). In this group are the Cass, Crete, Hastings, Hord, and Morrill soils. Data for a Mayberry profile in the report is given under its former name "Adair."

General Nature of the County

The first settlements in Jefferson County were the stations along the Oregon Trail.[9] The migration of people on the Oregon Trial began about 1842 and continued until 1867. Rock Creek Station, one of the more historical sites on the Oregon Trail, was established in 1857.

Jefferson County had four Pony Express Stations: Caldwells Station, the first Pony Express Station in Nebraska; Rock Creek Station, made famous by the fictitious stories of "Wild Bill" Hickok; Whisky Run Station, where one of the early mail robberies took place; and Big Sandy Station, one of the best home stations on the old trail. The Pony Express began service in the spring of 1860 and continued for about 18 months.

The first attempts at farming in Jefferson County were at Big Sandy near the mouth of Rock Creek in 1859. County boundaries were established in 1872. The population reached a peak of 16,852 in 1910 but decreased to 11,620 by 1960.

The first industry in the county was a lime kiln built by the U.S. Government in 1848.

Physiography, Relief, and Drainage

Jefferson County is entirely within the Loess Plains, a part of the Great Plains physiographic province. The underlying bedrock formations, such as interbedded limestone, shale, and sandstone, indicate that this area was once at the bottom of a sea or an ocean. Subsequently, glaciers moved across the eastern half of the county and brought large masses of soil material. As the climate changed, the glaciers melted, receded northward, and left material known as glacial till. At a later period, the county was covered with varying depths of light-gray to yellowish-brown silty loess. Loess still covers most of the county, except where erosion by wind and water has exposed the underlying formations. Such erosion is referred to as geologic erosion. Water erosion formed the upland terraces and the bottom land. The uplands are the most extensive of these features. The present terraces along the Blue River Valley were once bottom land that formed when streams were flowing at higher levels than at present. The present bottom land is on the flood plain of major drainageways. Some areas are subject to flooding.

The elevation ranges from about 1,540 feet in the western part of the county to 1,255 feet where the Little Blue River crosses the southern boundary of the county.

Relief ranges from slight to moderate. The most extensive, nearly level uplands are in the northern part of the county in the vicinities of Daykin and Plymouth. Uplands of reworked glacial till and bedrock range from nearly level to steep. The area of strongest relief is in the bedrock area in the southern part of the county. The bottom lands and strips of stream terraces are generally nearly level and range from a few rods wide along the smaller streams to 1.5 miles wide along the Little Blue River.

Streams of the county flow eastward and southeastward. The Little Blue River, the largest of the streams, drains the western and central parts of the county. Swan Creek drains the north-central part, and Cub Creek and Big Indian Creek drain the eastern part. Tributaries of the Little Blue River include Rose Creek, which drains the southern part of the county, and Big and Little Sandy Creeks, which drain the northwestern part.

Transportation and Markets

U.S. Highway 136 and State Highway 15 intersect at Fairbury, the county seat, near the middle of the county. State Route 8 crosses the southern part of the county, and State Route 4 runs east and west across the northern part. Hard surface roads connect all towns to the main highways that go into Fairbury. Rural roads are on most section lines, except in the rougher parts of the county, and many of these roads are graveled. Rural mail routes are on all weather roads in all parts of the county.

Three railroads cross the county. Airport facilities and a hard surface runway are available at Fairbury for small aircraft.

Nearly every town in Jefferson County provides market facilities for grain and deals in seed, fertilizer, and farm machinery. The principal farm market is in Fairbury.

Climate [10]

Jefferson County, in southeastern Nebraska, is near the center of a large land mass, hence the climate is continental. No bodies of water nearby are large enough to have a noticeable influence on the climate. Thundershowers occur in the warm summers and are followed by brief spells of cooler weather. Winters are generally cold and dry. Temperature and rainfall vary greatly from day to day and from season to season. Most of the moisture is brought in from the Gulf of Mexico and the Caribbean Sea. Generally, over three-fourths of the annual

[9] Historical information was furnished by the Jefferson County Historical Society.

[10] Prepared by RICHARD E. MYERS, state climatologist, National Weather Service, United States Department of Commerce.

precipitation occurs during the months of April to September, when the prevailing winds are from a southerly direction.

Slow steady rains or rain mixed with snow characterize the early part of spring. Snow is common during the first part of March, but by the latter half of the month, much of the precipitation falls as rain. Snow that falls in April seldom remains on the ground for more than a day. As spring advances, more and more of the moisture falls during brief showers. By mid-May most of the precipitation is from thundershowers. In spring and early in summer, thunderstorms become severe at times and may be accompanied by downpours, hail, damaging winds, and sometimes a tornado. The severe storms are generally local in extent and of short duration. The hail causes damage in an extremely variable and spotted pattern, but a total loss of crops has been reported in the center of the more intense storms. The loss may be severe or total on individual farms, but the associated rains cover a much larger area and often benefit the area as a whole.

Table 9 shows that generally more precipitation is received in June than in any other month. Actually the peak is reached during the first week in June, after which the showers gradually become lighter and farther apart. In fall the amount of precipitation received shows a definite downward trend; there are fewer thunderstorms and the weather is characterized by an abundance of sunshine, mild days, and cool nights.

The frequency of very dry or very wet months is also shown in table 9. For example, columns 6 and 7 indicate that an average of one July out of 10 will have less than 0.9 inch of precipitation and one out of 10 will receive over 8.1 inches.

Winter precipitation is generally light and most of it is snow. Most winters, however, have at least one period of rain or freezing rain. Average annual snowfall is about 30 inches, but varies considerably from year to year. Generally the snow melts before the next snowfall. In an average winter snow cover lasts for only 38 days.

The frequency of high and low temperatures is indicated in table 9. For example, column 3 shows that once in 5 years the temperature is 104° F. or higher on at least 4 days in July. Column 4 shows that once in 5 years, the temperature falls to 5 degrees below zero or lower on 4 nights in January. Temperatures have been recorded as high as 114° in 1936 and as low as −38° in 1899. The average annual high temperature is 105°, and the average annual low temperature is −13°.

The probabilities of freezing temperatures occurring after specified dates in the spring or before certain dates in the fall are shown in table 10. For example, in half the years the air temperature falls below 32° after April 26, the average date of last freeze, and in 1 year in 10 freezing temperatures occur as late as May 12th. In fall freezing temperatures are reported before September 30th in 1 year out of 10.

Annual free-water evaporation from shallow lakes or ponds averages about 46 inches. Approximately 75 percent of the evaporation occurs during the period May through October.

TABLE 9.—*Temperature and precipitation*

[Data from Fairbury, Nebraska]

Month	Temperature: Average daily maximum[1]	Temperature: Average daily minimum[1]	Temperature: Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than[2]	Temperature: Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than[2]	Precipitation: Average total[1]	Precipitation: One year in 10 will have— Less than[3]—	Precipitation: One year in 10 will have— More than[3]—	Precipitation: Days with 1 inch or more snow cover[4]	Precipitation: Average depth of snow on days with snow cover[4]
	°F.	°F.	°F.	°F.	In.	In.	In.		In.
January	35	14	56	−5	0.7	0.1	1.5	12	4
February	40	19	62	−1	1.0	.2	2.4	9	4
March	49	27	75	11	1.6	.3	3.0	6	4
April	64	40	83	26	2.5	.8	4.9	1	2
May	75	51	90	36	3.9	1.9	8.0	0	0
June	84	61	98	49	5.5	1.6	9.0	0	0
July	90	66	104	56	3.4	.9	8.1	0	0
August	89	64	102	53	4.1	1.0	7.8	0	0
September	80	54	98	39	3.5	.8	5.7	0	0
October	70	43	88	28	1.8	.4	4.1	(7)	2
November	52	28	71	14	1.0	.1	2.6	2	3
December	39	19	59	−1	.8	.1	1.6	8	4
Year	64	40	[5] 105	[6] −13	29.8	20.4	37.1	38	4

[1] Based on 1939–68 period of record.
[2] Based on 1895–1963 period of record.
[3] Based on 1876–1968 period of record.
[4] Based on 1934–63 period of record.
[5] Average annual maximum.
[6] Average annual minimum.
[7] Less than 0.5 day.

TABLE 10.—*Probabilities of selected temperatures in spring and fall*

[All freeze data are based on temperatures in a standard U.S. Weather Bureau thermometer shelter at a height of approximately 5 feet above the ground and in a representative exposure. Temperatures are lower at times nearer the ground and in local areas subject to extreme air drainage. All data from Fairbury, Nebr.]

Probability	Dates for given probability and temperature				
	16° F.	20° F.	24° F.	28° F.	32° F.
Spring:					
1 year in 10 later than	April 1	April 10	April 19	April 30	May 12
2 years in 10 later than	March 26	April 4	April 13	April 24	May 6
5 years in 10 later than	March 16	March 25	April 3	April 13	April 26
Fall:					
1 year in 10 earlier than	November 7	October 27	October 19	October 9	September 30
2 years in 10 earlier than	November 13	November 1	October 24	October 15	October 5
5 years in 10 earlier than	November 24	November 11	November 3	October 25	October 14

Farming

At present farming in the county is diversified, chiefly a cash-grain or a combination cash-grain and general livestock enterprise. The earliest farm enterprises consisted mainly of raising corn and vegetables for home consumption and for sale to the overland emigrants. Later the spring wheat, rye, oats, buckwheat, and flax were grown, in addition to the corn and garden vegetables.

As modern methods and knowledge came into use, yields increased, different crops were grown, and farming methods improved. Alfalfa, winter wheat, soybeans, and sorghum were introduced. Irrigation, new seed varieties, modern farm machinery, modern farming methods, insecticides, herbicides, and fertilizers are used for maximum production in present day farming.

Improved strains and feeding practices for livestock have increased production to the present high level.

Irrigated crops have become an important part of the economy since the late 1950's. As of January 1, 1972, there were 280 registered irrigation wells, generally in the northern part of the county. These wells were used to irrigate 30,200 acres in 1971. Corn and grain sorghum are the principal irrigated crops (*2*).

The average depth of irrigation wells in Jefferson County is 174 feet. At a static water level the pumping rate is about 900 gallons per minute. An average of more than 100 acres is irrigated by each well.

The number of farms in the county is decreasing slightly. In 1971 there were 890 farms in the county (*2*).

Water Supply

The Little Blue River, Rose Creek, and Big Sandy Creek, all perennial streams, are a source of water for livestock and recreation throughout the year and for irrigation in summer. The other streams in the county flow intermittently. Small earthen dams are on many of the upland drainageways. They are mainly used to store runoff water for use by livestock. A few farms use the water for irrigation.

Thick beds of water-saturated sand and gravel underlie much of the northern one-fourth of Jefferson County, the valleys of the Little Blue River and Rose Creek, and an area along an ancient valley that extends east-west across the southern part of the county and ranges from about 1 to 5 miles wide. The water in these areas is of good quality, and wells that have yields ranging from 250 to 1,500 gallons per minute can be developed in most places.

Soils in the southern and central parts of Jefferson County are fairly shallow over bedrock. Water of good quality for domestic use is obtained in this area from shallow wells where water-saturated sands occur above the bedrock. Water in which the mineral content is moderate to high is available from wells that penetrate fractures and openings in the bedrock. Shallow wells generally have low yields of good quality water. Deep wells yield larger amounts of water, and in places the water is high in minerals.

The 27 watershed reservoirs constructed in the county contribute approximately 1,020 acres of surface water. They range from 15 to 65 acres in size. The lakes are used for recreation and wildlife and provide a limited supply of water for irrigation.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity. The capacity to store water available for use by plants, usually expressed in linear depths of water per unit depth of soil. Commonly defined as the difference between the percentage of soil water at field capacity and the percentage at wilting point. This difference multiplied by the bulk density and divided by 100 gives a value in surface inches of water per inch depth of soil. In this survey, the classes of available water capacity for a 60-inch profile, or to a limiting layer are:

0 to 3 inches	very low
3 to 6 inches	low
6 to 9 inches	moderate
More than 9 inches	high

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth (soil). The thickness of weathered soil material over mixed sand and gravel. In this survey the classes of soil depth are as follows:

Very shallow	0 to 10 inches
Shallow	10 to 20 inches
Moderately deep	20 to 40 inches
Deep	more than 40 inches

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and upper part of the B horizon and have mottling in the lower part of the B horizon and the C horizon.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability, soil. The quality that enables the soil to transmit water or air. In this survey, permeability applies to that part of the soil below the Ap, or equivalent, layer and above a depth of 60 inches, or to bedrock that occurs at a shallower depth. Where there is a change of two or more permeability classes within a short vertical distance, the classes and depths will be stated. Classes of soil permeability in inches of water per hour are as follows:

Less than 0.06	very slow
0.06 to 0.2	slow
0.2 to 0.6	moderately slow
0.6 to 2.0	moderate
2.0 to 6.0	moderately rapid
6.0 to 20.0	rapid
20.0 and over	very rapid

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline.	9.1 and higher

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope. The degree of deviation of a surface from the horizontal, usually expressed in percent or degrees. In this survey, the following slope classes are recognized:

0 to 1 percent	nearly level
1 to 3 percent	gently sloping
3 to 7 percent	moderately sloping
7 to 11 percent	strongly sloping
11 to 31 percent	steep
More than 31 percent	very steep

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty cly loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil srtucture. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Underlying material. Weathered soil material immediately beneath the solum.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. All windbreak groups are described on page 44. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 39.
Engineering uses of the soils, tables 5, 6, and 7, pages 48 through 61.

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
BdB	Burchard clay loam, 3 to 7 percent slopes	11	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
BdC	Burchard clay loam, 7 to 11 percent slopes	11	IVe-1	34	----	--	Silty	42	Silty to Clayey
BdC3	Burchard clay loam, 7 to 11 percent slopes, severely eroded	11	IVe-8	36	----	--	Silty	42	Silty to Clayey
BdE	Burchard clay loam, 11 to 30 percent slopes	11	VIe-1	37	----	--	Silty	42	Silty to Clayey
BfB2	Benfield silty clay loam, 3 to 7 percent slopes, eroded	9	IIIe-2	34	IIIe-21	34	Clayey	42	Silty to Clayey
BfC	Benfield silty clay loam, 7 to 11 percent slopes	9	IVe-2	35	----	--	Clayey	42	Silty to Clayey
BfC2	Benfield silty clay loam, 7 to 11 percent slopes, eroded	10	IVe-2	35	----	--	Clayey	42	Silty to Clayey
BfD	Benfield silty clay loam, 11 to 30 percent slopes	10	VIe-1	37	----	--	Silty	42	Silty to Clayey
Bu	Butler silt loam	12	IIw-2	33	IIs-21	33	Clayey	42	Silty to Clayey
Ce	Crete silt loam, 0 to 1 percent slopes	13	IIs-2	33	IIs-2	33	Clayey	42	Silty to Clayey
CeA	Crete silt loam, 1 to 3 percent slopes	13	IIe-2	32	IIIe-2	32	Clayey	42	Silty to Clayey
CeC	Crete silt loam, 7 to 11 percent slopes	13	IVe-2	35	----	--	Clayey	42	Silty to Clayey
Cm	Cass loam	12	I-1	31	I-1	31	Silty Lowland	42	Moderately Wet
2Cm	Cass loam, occasionally flooded	12	IIw-3	33	I-2	33	Silty Overflow	42	Moderately Wet
CrB2	Crete silty clay loam, 3 to 7 percent slopes, eroded	13	IIIe-2	34	IIIe-21	34	Clayey	42	Silty to Clayey
EdB2	Edalgo silty clay loam, 3 to 7 percent slopes, eroded	14	IIIe-2	34	IIIe-21	34	Clayey	42	Silty to Clayey
EdC	Edalgo silty clay loam, 7 to 11 percent slopes	15	IVe-2	35	----	--	Clayey	42	Silty to Clayey
GeB	Geary silty clay loam, 3 to 7 percent slopes	15	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
GeB2	Geary silty clay loam, 3 to 7 percent slopes, eroded	15	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
GeC	Geary silty clay loam, 7 to 11 percent slopes	16	IVe-1	34	----	--	Silty	42	Silty to Clayey
GeC3	Geary silty clay loam, 3 to 11 percent slopes, severely eroded	16	IVe-8	36	----	--	Silty	42	Silty to Clayey

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
GeE	Geary silty clay loam, 11 to 30 percent slopes	16	VIe-1	37	----	--	Silty	42	Silty to Clayey
GJC	Geary and Jansen soils, 5 to 11 percent slopes	16	IVe-1	34	----	--	Silty	42	Silty to Clayey
GJC2	Geary and Jansen soils, 5 to 11 percent slopes, eroded	16	IVe-1	34	----	--	Silty	42	Silty to Clayey
GJC3	Geary and Jansen soils, 5 to 11 percent slopes, severely eroded	16	IVe-8	36	----	--	Silty	42	Silty to Clayey
GJE	Geary and Jansen soils, 11 to 30 percent slopes	17	VIe-1	37	----	--	Silty	42	Silty to Clayey
GP	Gravel pits	17	VIIIs-1	37	----	--	----	--	------
2Hb	Hobbs silt loam, occasionally flooded	20	IIw-3	33	I-2	33	Silty Overflow	42	Moderately Wet
Hb	Hobbs silt loam, 0 to 1 percent slopes	20	I-1	31	I-1	31	Silty Lowland	42	Silty to Clayey
HbA	Hobbs silt loam, 1 to 3 percent slopes	20	IIe-1	31	IIe-1	31	Silty Lowland	42	Silty to Clayey
Hd	Hord silt loam, 0 to 1 percent slopes	21	I-1	31	I-1	31	Silty Lowland	42	Silty to Clayey
HdA	Hord silt loam, 1 to 3 percent slopes	21	IIe-1	31	IIe-1	31	Silty Lowland	42	Silty to Clayey
HsA	Hastings silt loam, 1 to 3 percent slopes	18	IIe-1	31	IIe-1	31	Silty	42	Silty to Clayey
HsB	Hastings silt loam, 3 to 7 percent slopes	18	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
HsC	Hastings silt loam, 7 to 11 percent slopes	18	IVe-1	34	----	--	Silty	42	Silty to Clayey
HtB2	Hastings silty clay loam, 3 to 7 percent slopes, eroded	18	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
HtC3	Hastings silty clay loam, 3 to 11 percent slopes, severely eroded	18	IVe-8	36	----	--	Silty	42	Silty to Clayey
HvE	Hedville loam, 7 to 30 percent slopes	19	VIs-4	37	----	--	Shallow Sandy	43	Shallow
JaB	Jansen loam, 3 to 7 percent slopes	22	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
JaB2	Jansen loam, 3 to 7 percent slopes, eroded	22	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
JaC	Jansen loam, 7 to 11 percent slopes	22	IVe-1	34	----	--	Silty	42	Silty to Clayey
KsD	Kipson silt loam, 7 to 30 percent slopes	22	VIs-4	37	----	--	Shallow Limy	43	Shallow
LanC3	Lancaster soils, 7 to 11 percent slopes, severely eroded	23	IVe-8	36	----	--	Silty	42	Silty to Clayey
LcB2	Lancaster loam, 3 to 7 percent slopes, eroded	23	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
LcC	Lancaster loam, 7 to 11 percent slopes	23	IVe-1	34	----	--	Silty	42	Silty to Clayey
LEE	Lancaster and Edalgo soils, 11 to 30 percent slopes	24							
	Lancaster soil	--	VIe-1	37	----	--	Silty	42	Silty to Clayey
	Edalgo soil	--	VIe-1	37	----	--	Clayey	42	Silty to Clayey

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
MaaB2	Mayberry silty clay loam, 3 to 7 percent slopes, eroded------------	25	IIIe-2	34	IIIe-21	34	Clayey	42	Silty to Clayey
MaaC	Mayberry silty clay loam, 7 to 11 percent slopes----	25	IVe-2	35	----	--	Clayey	42	Silty to Clayey
MadC3	Mayberry clay, 3 to 11 percent slopes, severely eroded--------------------	25	IVe-2	35	----	--	Clayey	42	Silty to Clayey
MC3	Morrill soils, 3 to 11 percent slopes, severely eroded--------------------	28	IVe-8	36	----	--	Silty	42	Silty to Clayey
MnC2	Malcolm silt loam, 7 to 11 percent slopes, eroded----	24	IVe-1	34	----	--	Silty	42	Silty to Clayey
MrB	Morrill clay loam, 3 to 7 percent slopes------------	27	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
MrB2	Morrill clay loam, 3 to 7 percent slopes, eroded----	27	IIIe-1	34	IIIe-1	34	Silty	42	Silty to Clayey
MrC	Morrill clay loam, 7 to 11 percent slopes------------	28	IVe-1	34	----	--	Silty	42	Silty to Clayey
MrE	Morrill clay loam, 11 to 30 percent slopes---------	28	VIe-1	37	----	--	Silty	42	Silty to Clayey
MwD	Meadin loam, 7 to 30 percent slopes------------	26	VIs-4	37	----	--	Shallow to Gravel	43	Shallow
Rv	Rough stony land------------	28	VIIs-3	37	----	--	Shallow Sandy	43	Undesirable
Sx	Sandy alluvial land---------	28	VIIIw-1	37	----	--	----	--	Undesirable
Sy	Silty alluvial land---------	28	VIw-1	37	----	--	Silty Overflow	42	Undesirable
Wx	Wet alluvial land-----------	29	Vw-1	36	----	--	Wet Land	42	Undesirable

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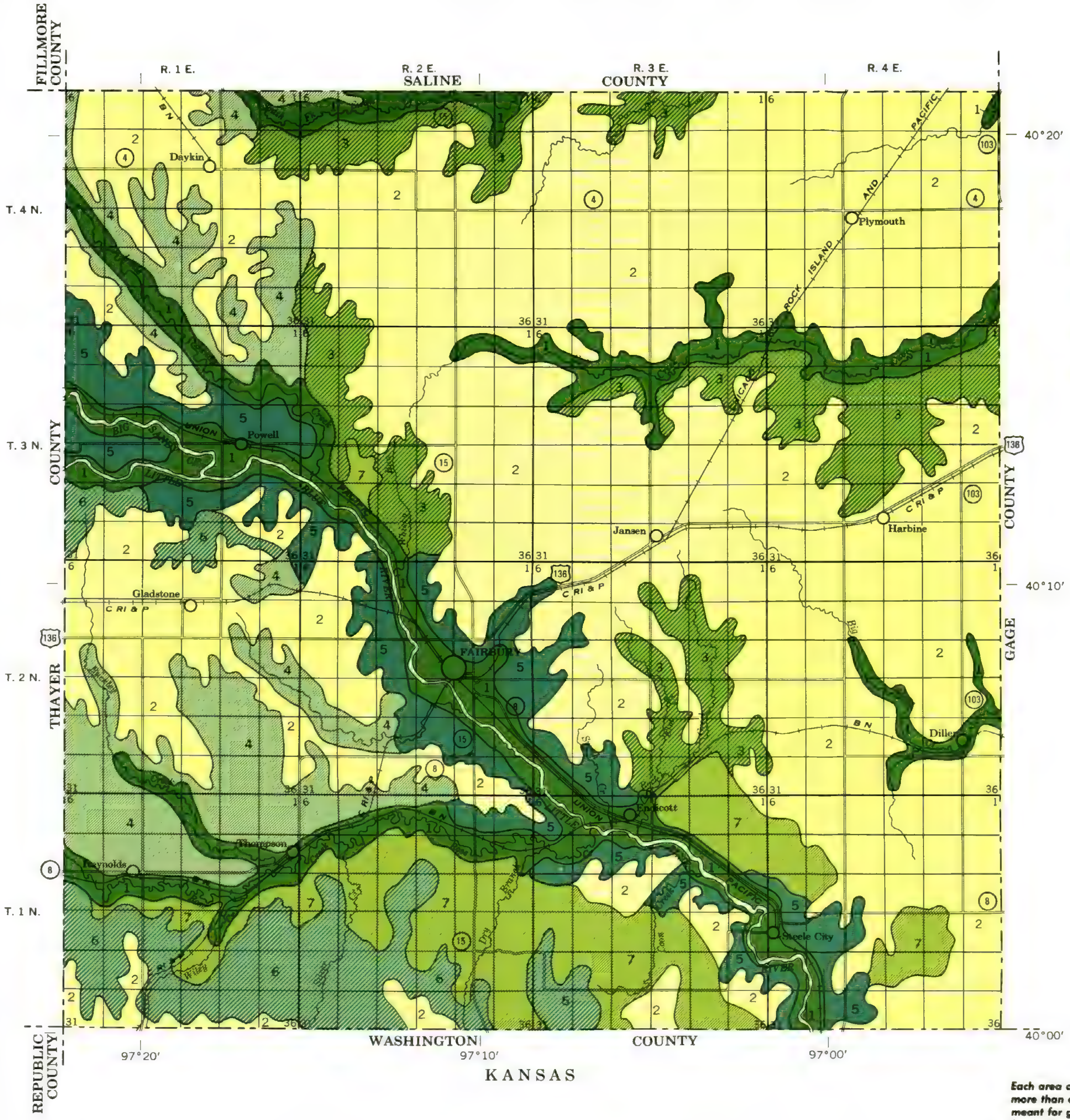


SOIL ASSOCIATIONS *

1	Hobbs-Hord-Cass association: Nearly level and gently sloping, deep silty and loamy soils on alluvial benches and bottom land
2	Crete-Mayberry association: Nearly level to strongly sloping, deep soils that have a silty surface layer and a clayey subsoil; on loess and glaciated uplands
3	Morrill-Burchard association: Moderately sloping to steep, deep loamy soils on glaciated uplands
4	Geary-Hastings association: Gently sloping to steep, deep silty soils on loess uplands
5	Geary-Jansen association: Moderately sloping to steep, deep silty and loamy soils that formed in loess, and moderately sloping to steep loamy soils that are moderately deep over gravel; on uplands
6	Benfield-Kipson association: Moderately sloping to steep, moderately deep and shallow silty soils that have a clayey to silty subsoil; on limestone uplands
7	Lancaster-Hedville association: Moderately sloping to steep, moderately deep and shallow loamy soils on sandstone and sandy shale uplands

*Texture refers to the surface layer unless otherwise mentioned.

Compiled 1973

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

UNIVERSITY OF NEBRASKA, CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

JEFFERSON COUNTY, NEBRASKA

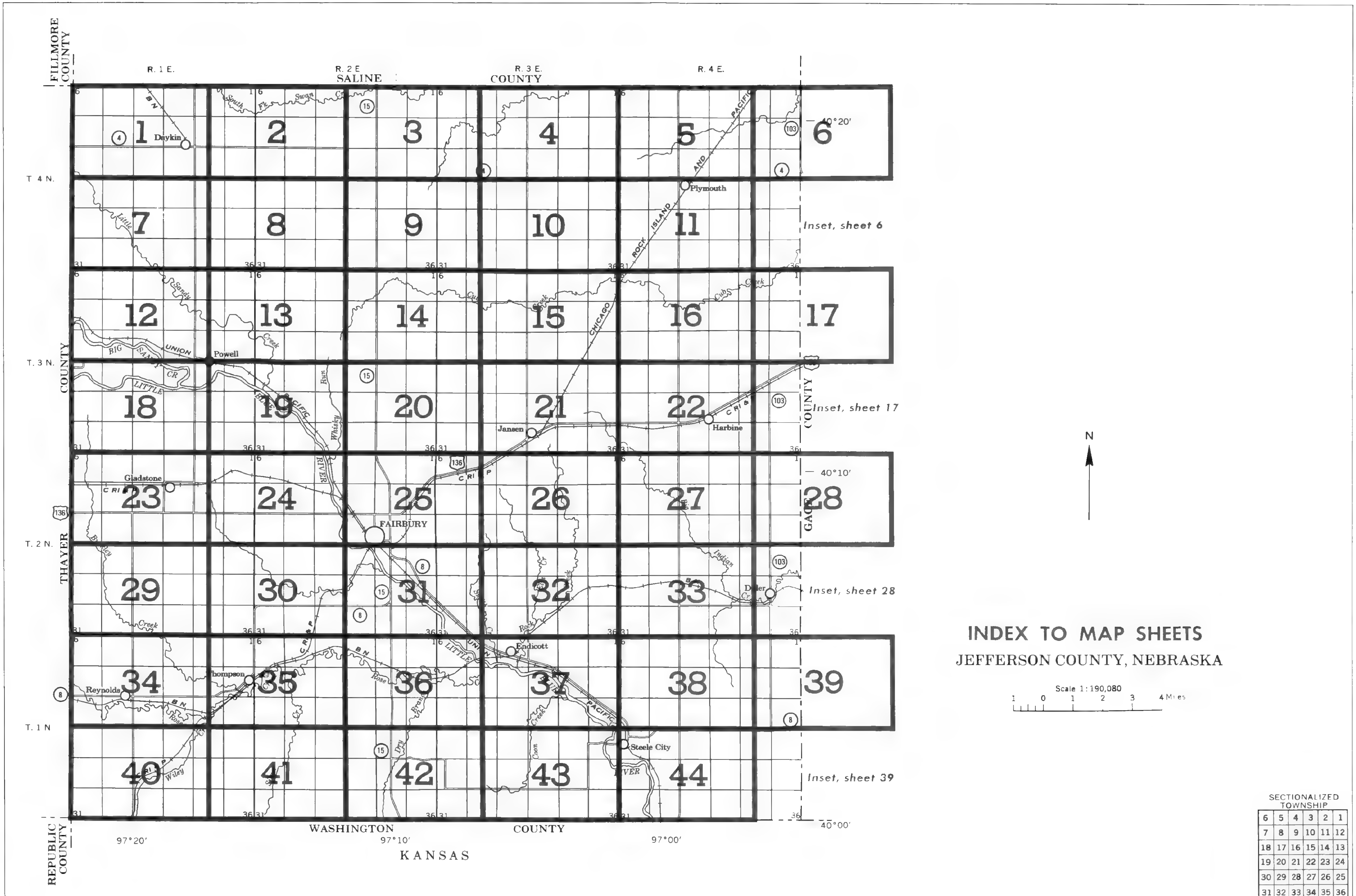
Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS

JEFFERSON COUNTY, NEBRASKA

SOIL LEGEND

Each soil symbol consists of letters, or of letters and numbers; for example, GJC, Hb, 2HB or HtB2. If slope is given in the soil name and is more than 1 percent, the last capital letter, A, B, C, D, or E, in a symbol shows the slope class. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
BdB	Burchard clay loam, 3 to 7 percent slopes
BdC	Burchard clay loam, 7 to 11 percent slopes
BdC3	Burchard clay loam, 7 to 11 percent slopes, severely eroded
BdE	Burchard clay loam, 11 to 30 percent slopes
BfB2	Benfield silty clay loam, 3 to 7 percent slopes, eroded
BfC	Benfield silty clay loam, 7 to 11 percent slopes
BfC2	Benfield silty clay loam, 7 to 11 percent slopes, eroded
BfD	Benfield silty clay loam, 11 to 30 percent slopes
Bu	Butler silt loam
Ce	Crete silt loam, 0 to 1 percent slopes
CeA	Crete silt loam, 1 to 3 percent slopes
CeC	Crete silt loam, 7 to 11 percent slopes
Cm	Cass loam
2Cm	Cass loam, occasionally flooded
CrB2	Crete silty clay loam, 3 to 7 percent slopes, eroded
EdB2	Edalgo silty clay loam, 3 to 7 percent slopes, eroded
EdC	Edalgo silty clay loam, 7 to 11 percent slopes
GeB	Geary silty clay loam, 3 to 7 percent slopes
GeB2	Geary silty clay loam, 3 to 7 percent slopes, eroded
GeC	Geary silty clay loam, 7 to 11 percent slopes
GeC3	Geary silty clay loam, 3 to 11 percent slopes, severely eroded
GeE	Geary silty clay loam, 11 to 30 percent slopes
GJC	Geary and Jansen soils, 5 to 11 percent slopes
GJC2	Geary and Jansen soils, 5 to 11 percent slopes, eroded
GJC3	Geary and Jansen soils, 5 to 11 percent slopes, severely eroded
GJE	Geary and Jansen soils, 11 to 30 percent slopes
GP	Gravel pits
Hb	Hobbs silt loam, 0 to 1 percent slopes
2Hb	Hobbs silt loam, occasionally flooded
HbA	Hobbs silt loam, 1 to 3 percent slopes
Hd	Hord silt loam, 0 to 1 percent slopes
HdA	Hord silt loam, 1 to 3 percent slopes
HsA	Hastings silt loam, 1 to 3 percent slopes
HsB	Hastings silt loam, 3 to 7 percent slopes
HsC	Hastings silt loam, 7 to 11 percent slopes
HtB2	Hastings silty clay loam, 3 to 7 percent slopes, eroded
HtC3	Hastings silty clay loam, 3 to 11 percent slopes, severely eroded
HvE	Hedville loam, 7 to 30 percent slopes
JaB	Jansen loam, 3 to 7 percent slopes
JaB2	Jansen loam, 3 to 7 percent slopes, eroded
JaC	Jansen loam, 7 to 11 percent slopes
KsD	Kipson silt loam, 7 to 30 percent slopes
LanC3	Lancaster soils, 7 to 11 percent slopes, severely eroded
LcB2	Lancaster loam, 3 to 7 percent slopes, eroded
LcC	Lancaster loam, 7 to 11 percent slopes
LEE	Lancaster and Edalgo soils, 11 to 30 percent slopes
MaaB2	Mayberry silty clay loam, 3 to 7 percent slopes, eroded
MaaC	Mayberry silty clay loam, 7 to 11 percent slopes
MadC3	Mayberry clay, 3 to 11 percent slopes, severely eroded
MC3	Morrill soils, 3 to 11 percent slopes, severely eroded
MnC2	Malcolm silt loam, 7 to 11 percent slopes, eroded
MrB	Morrill clay loam, 3 to 7 percent slopes
MrB2	Morrill clay loam, 3 to 7 percent slopes, eroded
MrC	Morrill clay loam, 7 to 11 percent slopes
MrE	Morrill clay loam, 11 to 30 percent slopes
MwD	Meadin loam, 7 to 30 percent slopes
Rv	Rough stony land
Sx	Sandy alluvial land
Sy	Silty alluvial land
Wx	Wet alluvial land

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry — FY
- Ford — FORD
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial — water, w
- Intermittent — int

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

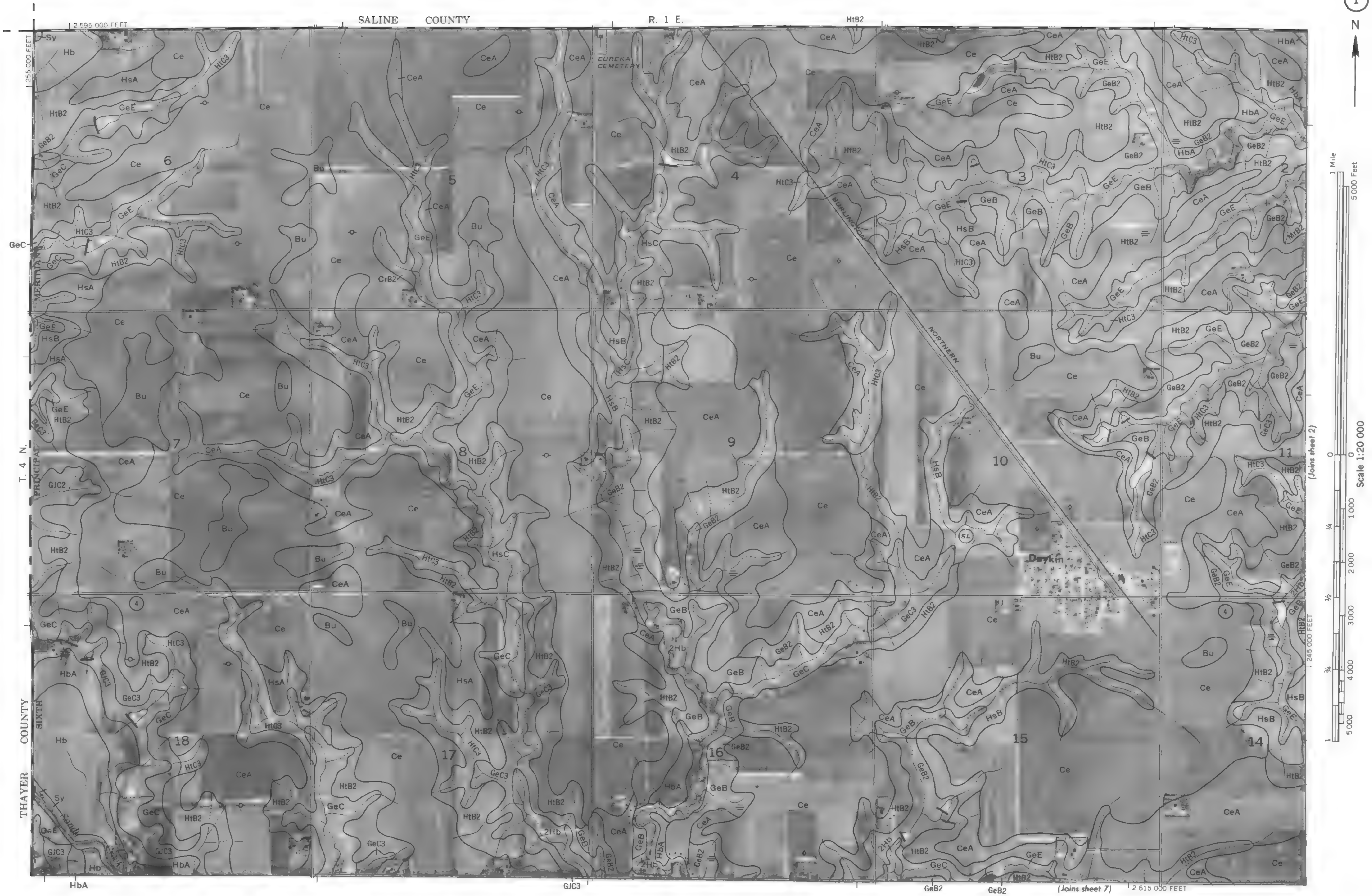
Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot



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JEFFERSON COUNTY, NEBRASKA NO. 1

JEFFERSON COUNTY, NEBRASKA NO. 2

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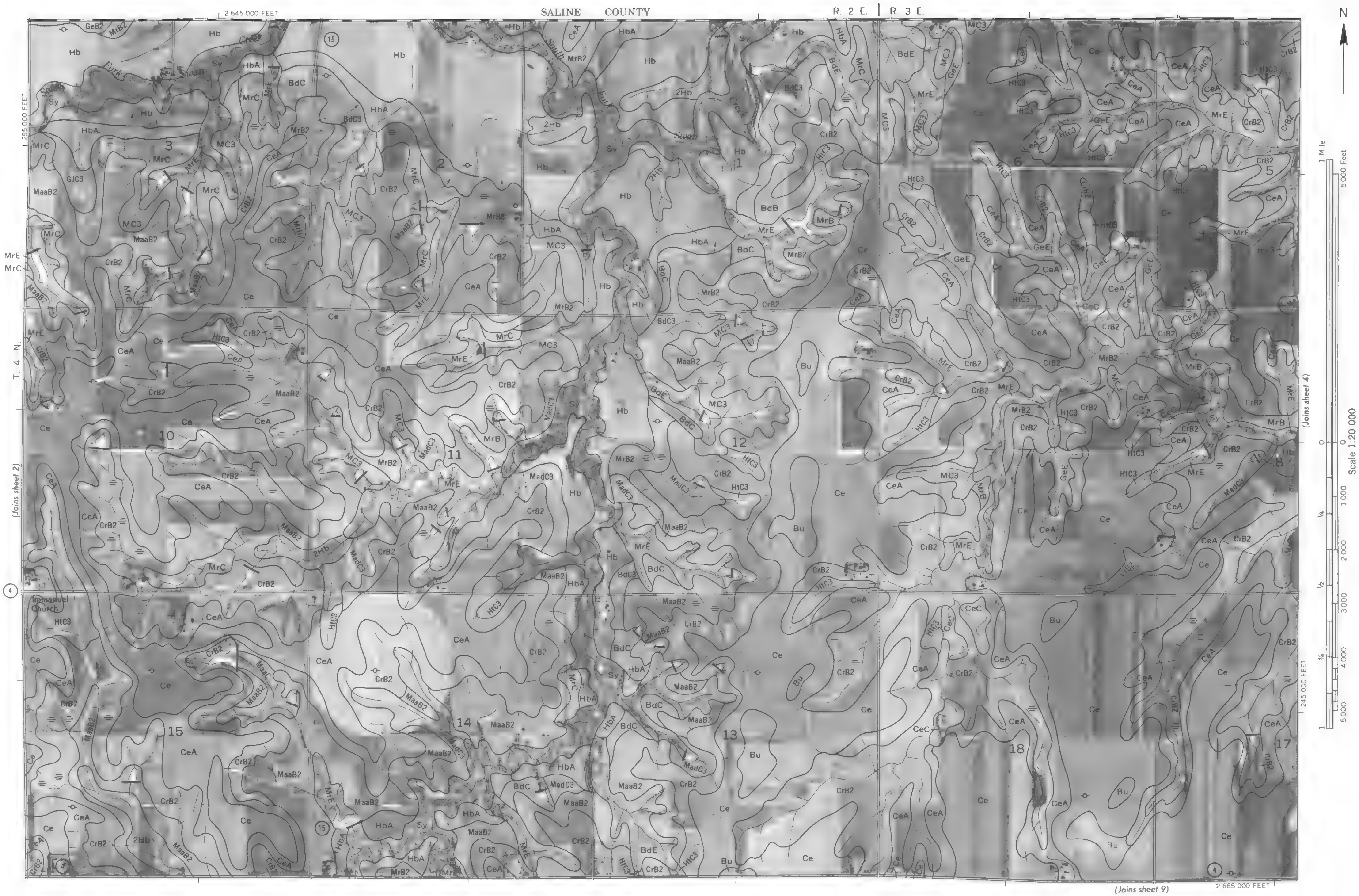

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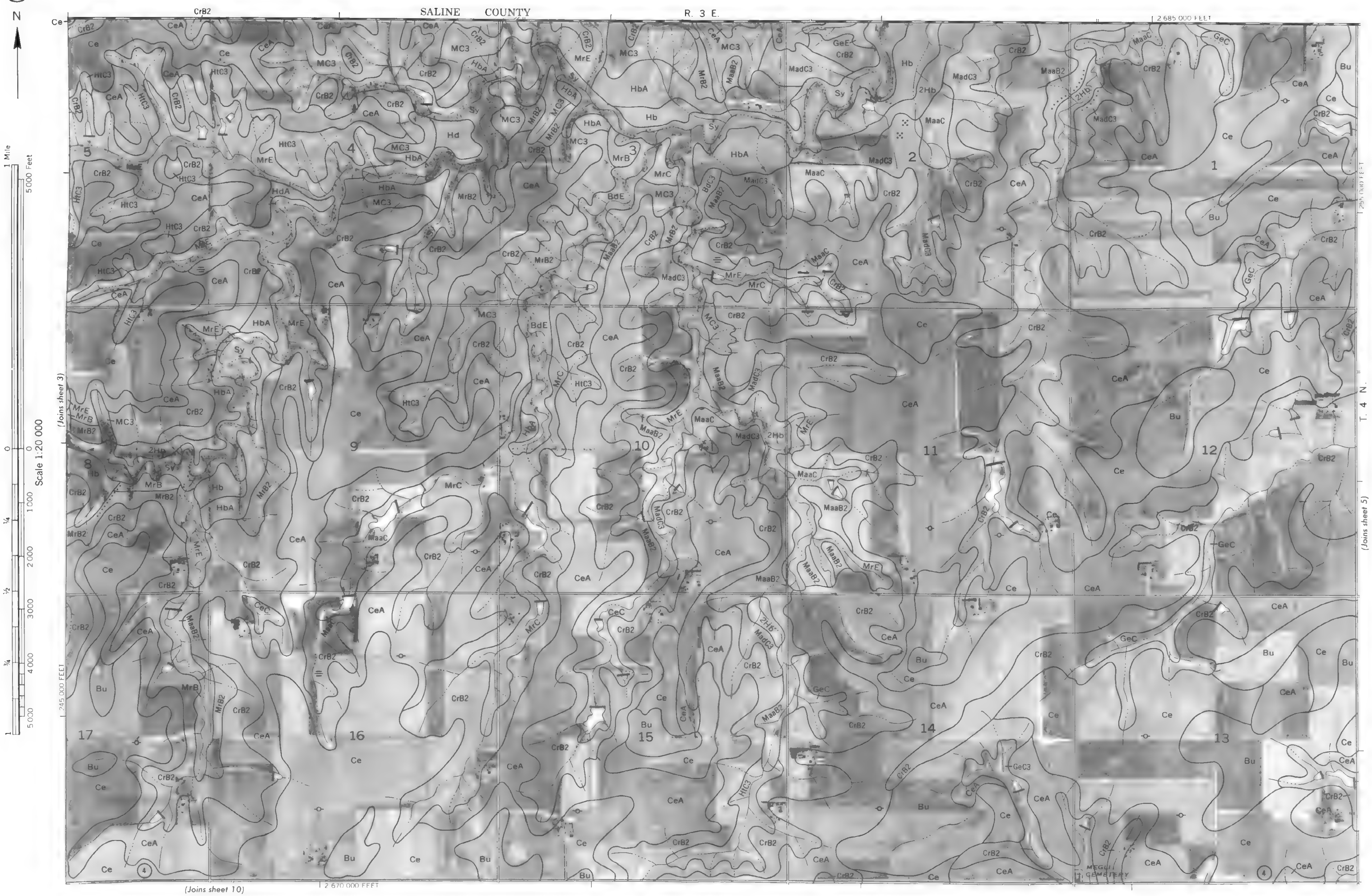
JEFFERSON COUNTY, NEBRASKA NO. 3

4

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 4



JEFFERSON COUNTY, NEBRASKA NO. 4

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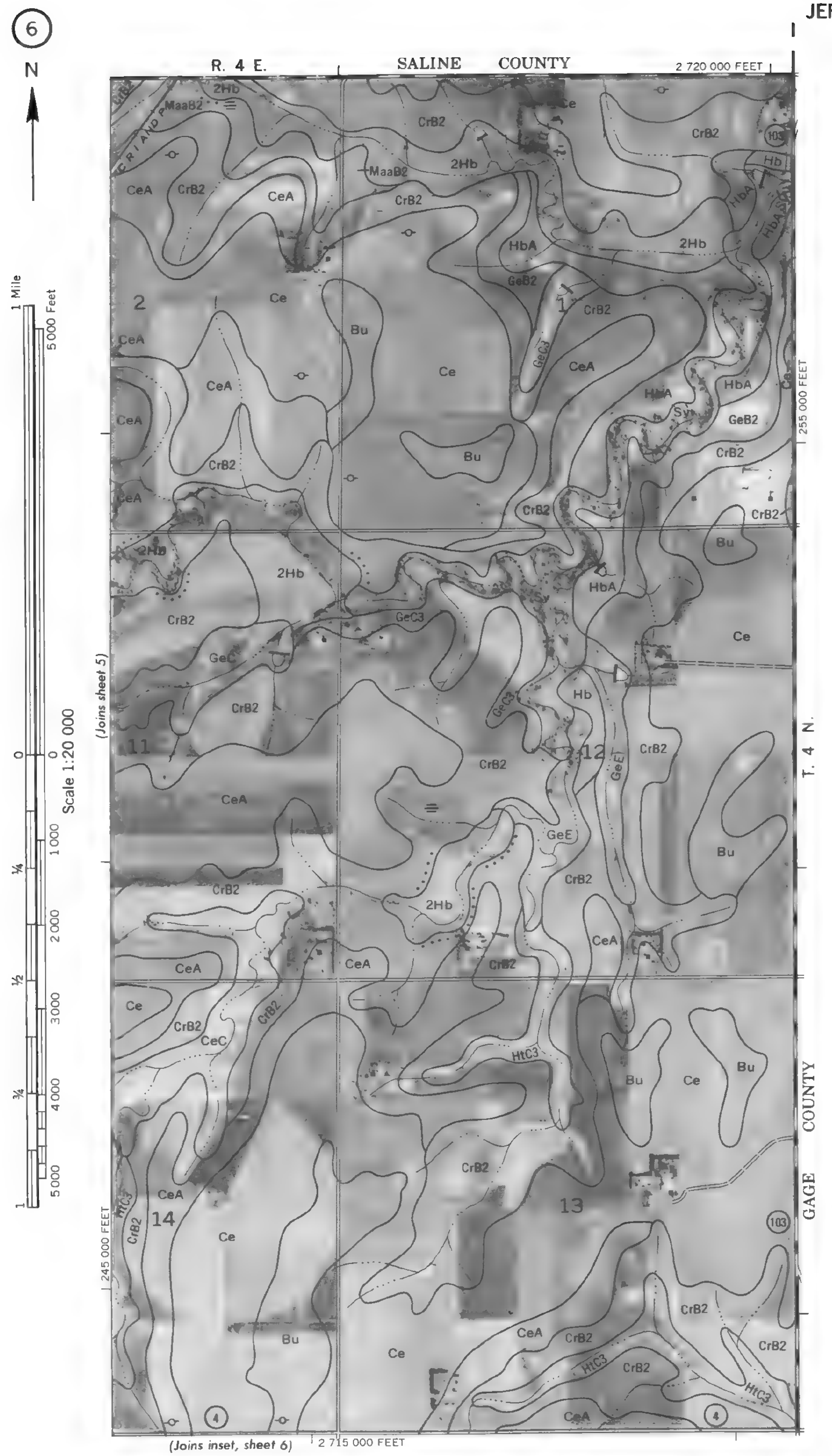
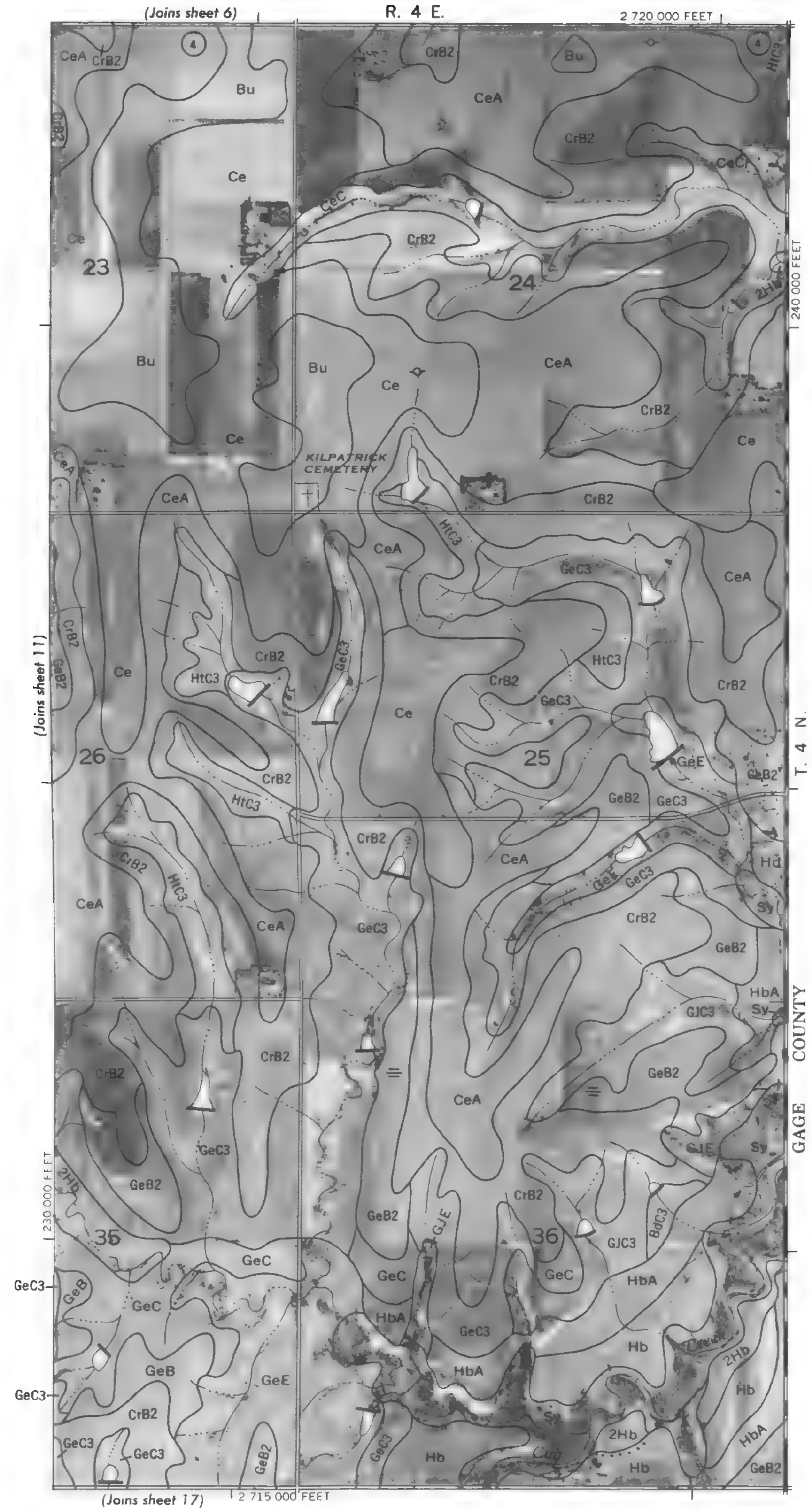
JEFFERSON COUNTY, NEBRASKA NO. 5





JEFFERSON COUNTY, NEBRASKA NO. 6

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JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 7

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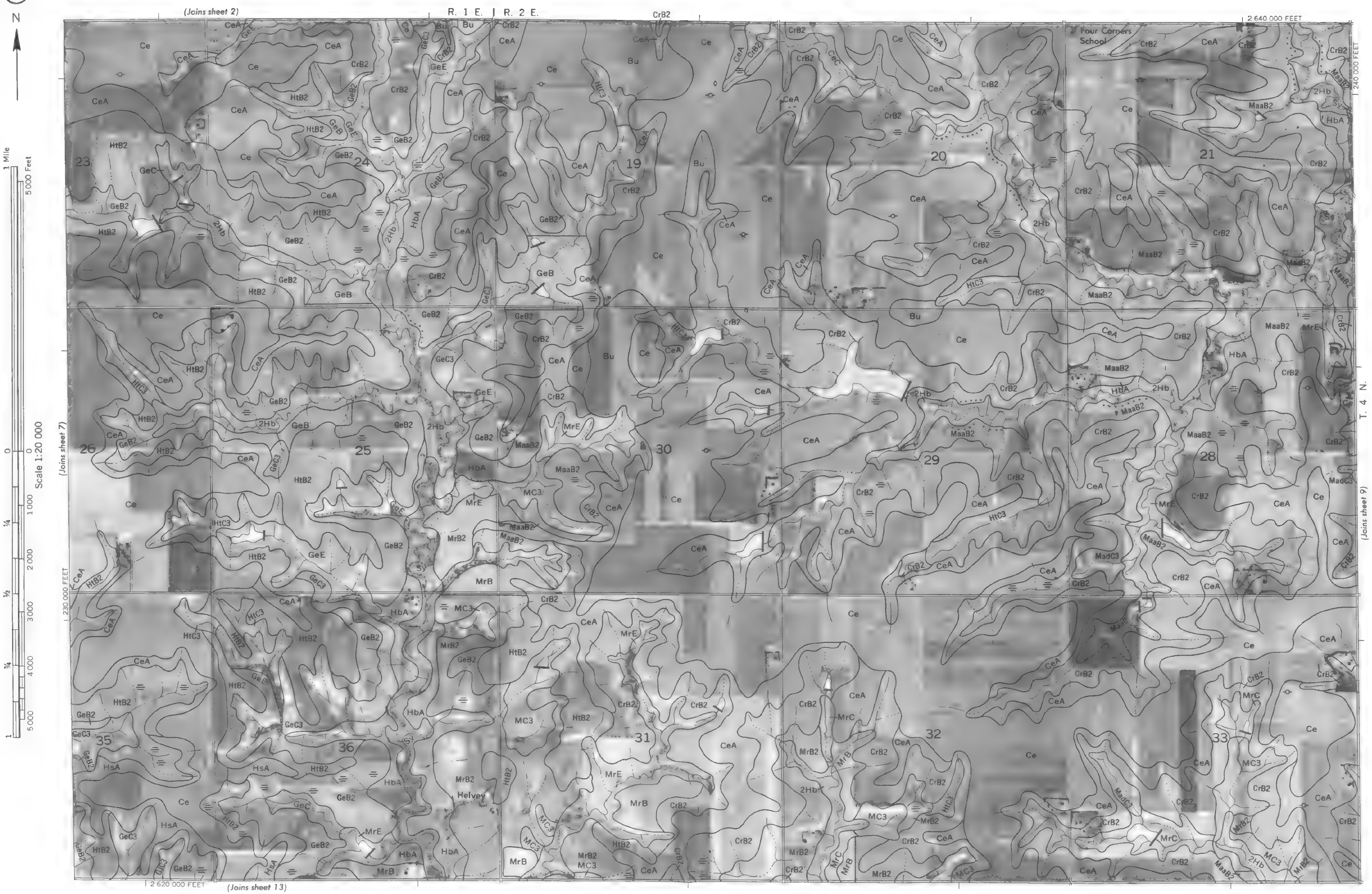
JEFFERSON COUNTY, NEBRASKA NO. 7

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 8



JEFFERSON COUNTY, NEBRASKA NO. 8

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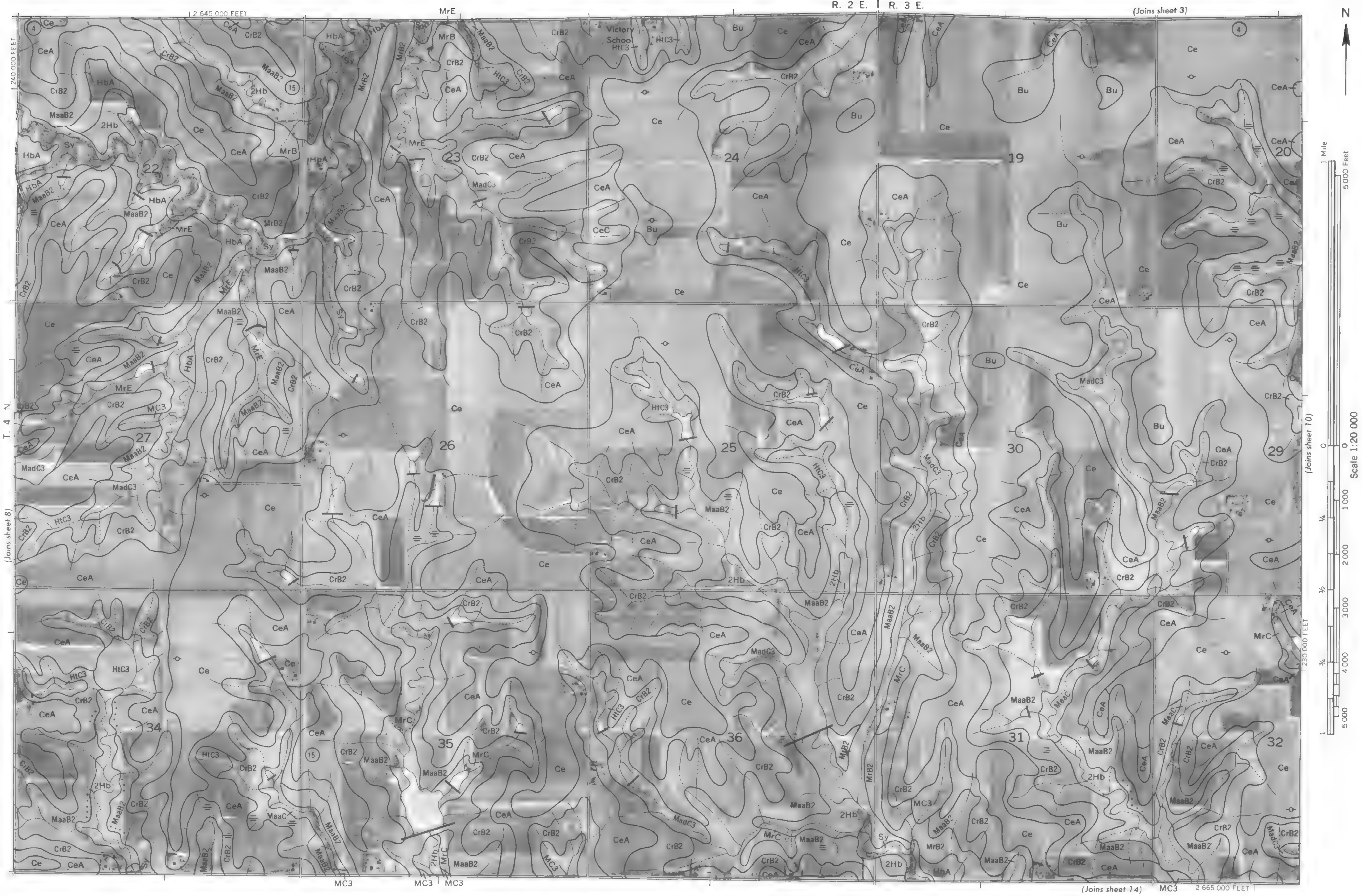

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JEFFERSON COUNTY, NEBRASKA NO. 9

JEFFERSON COUNTY, NEBRASKA NO. 10

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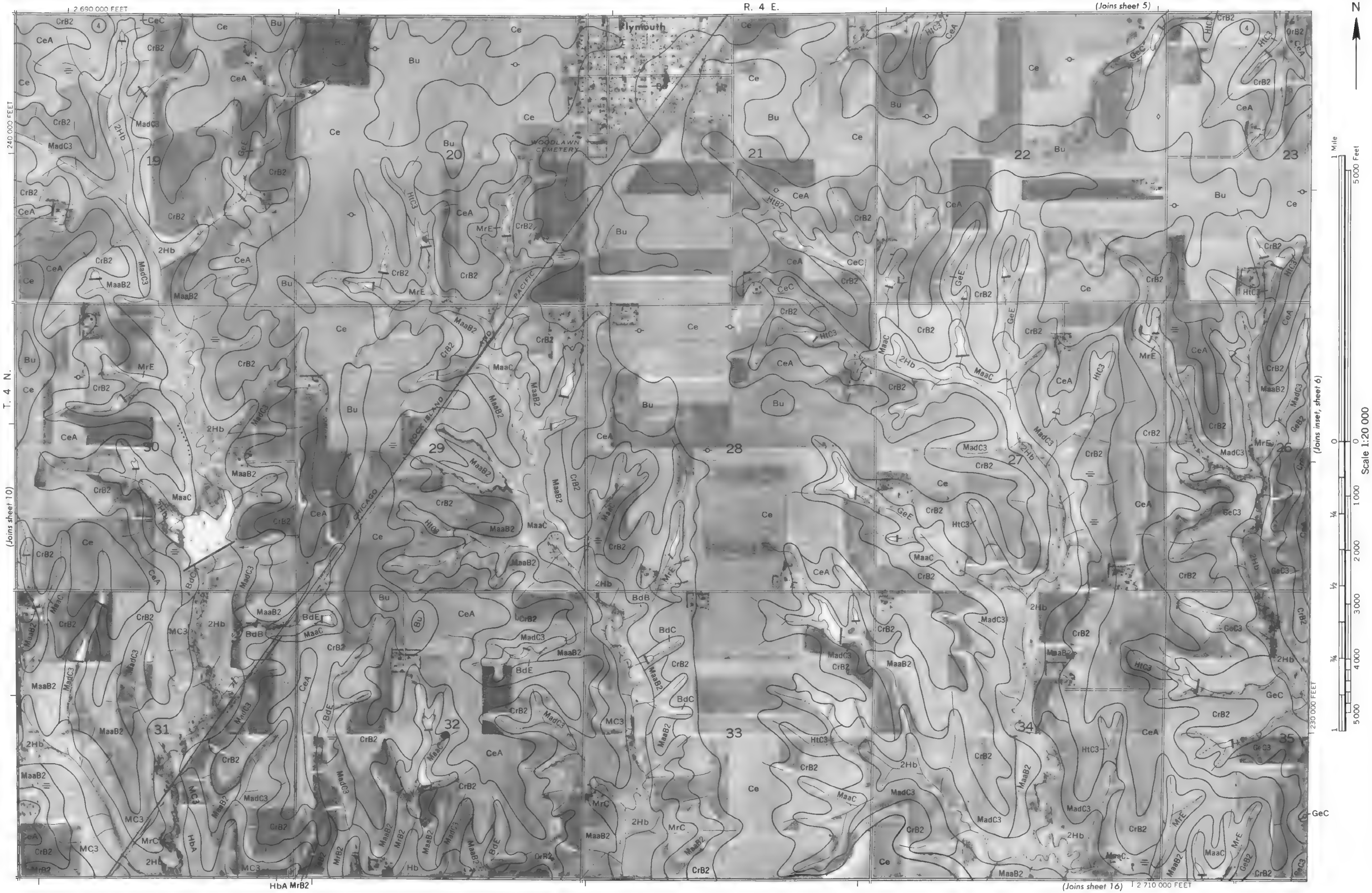
JEFFERSON COUNTY, NEBRASKA NO. 11



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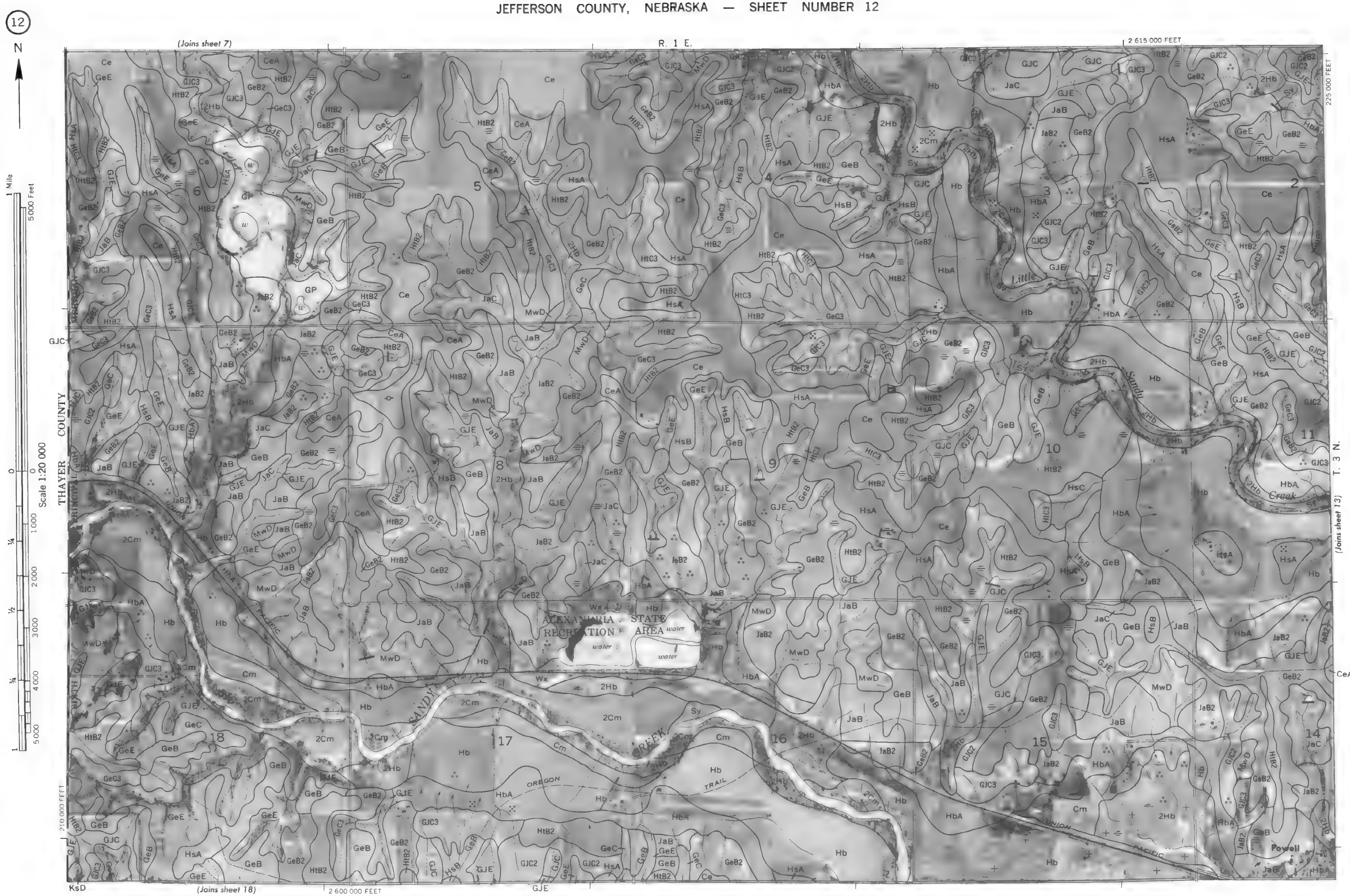

JEFFERSON COUNTY, NEBRASKA NO. 12

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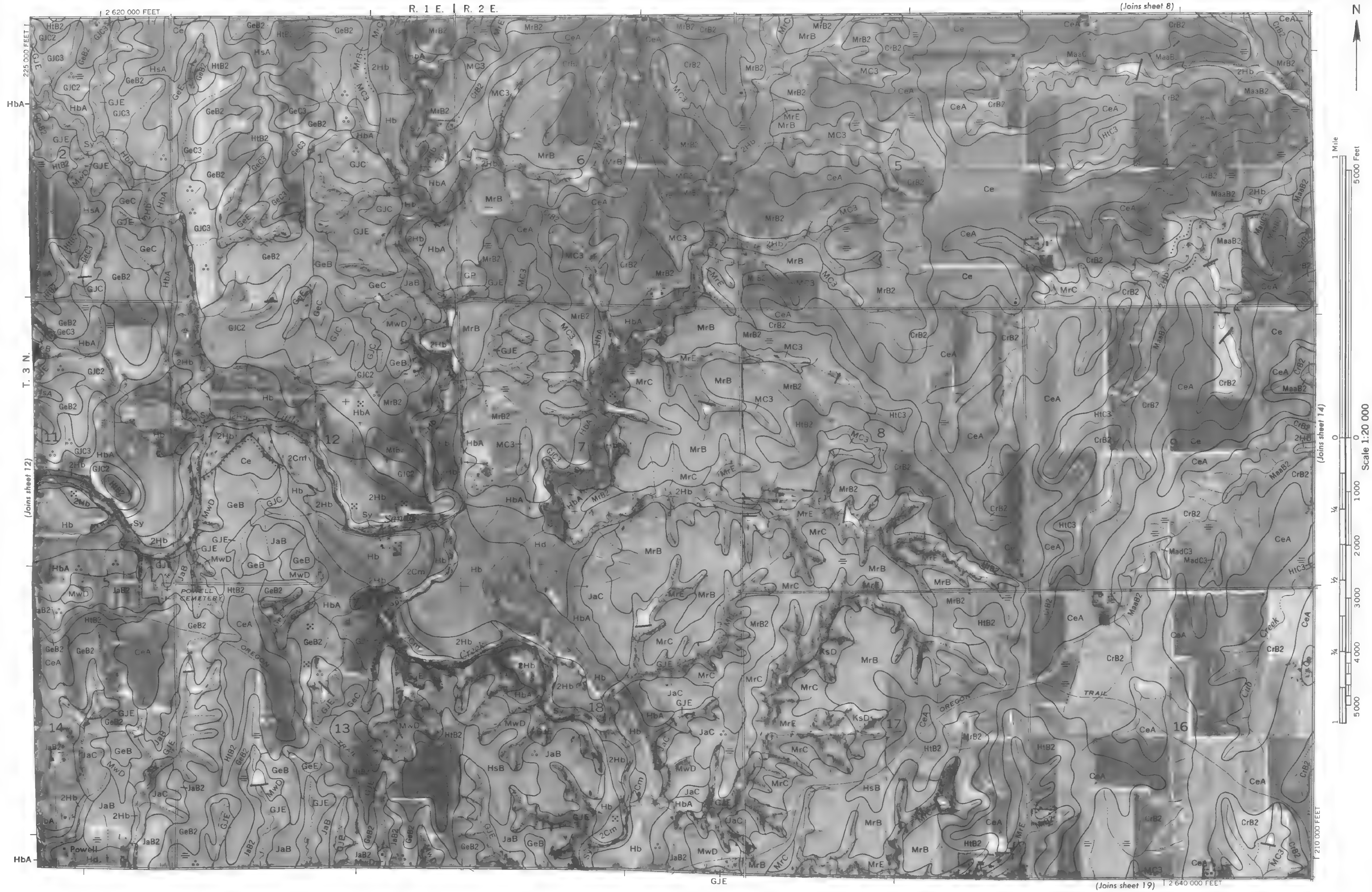
13



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JEFFERSON COUNTY, NEBRASKA NO. 13

JEFFERSON COUNTY, NEBRASKA NO. 14

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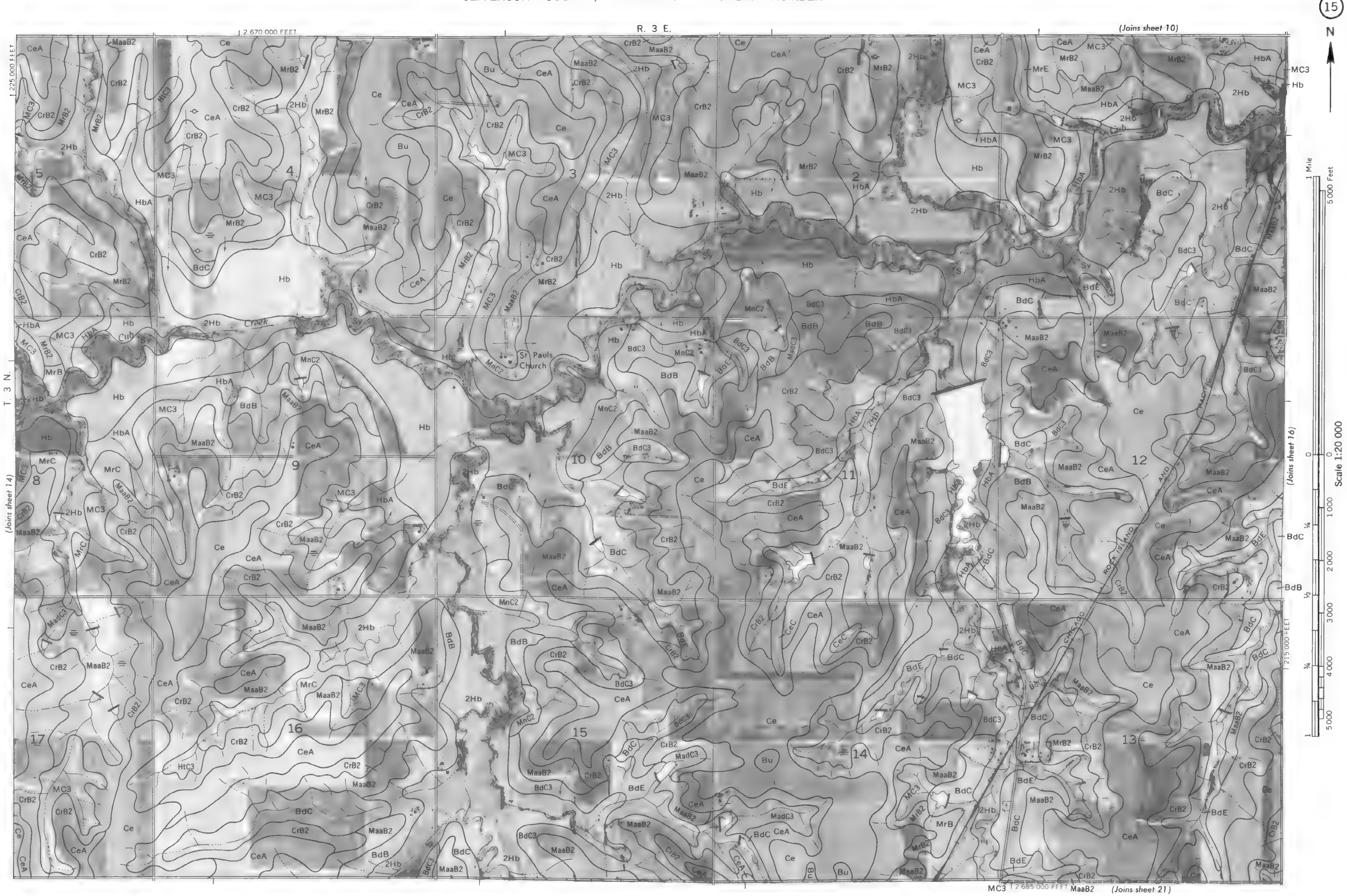

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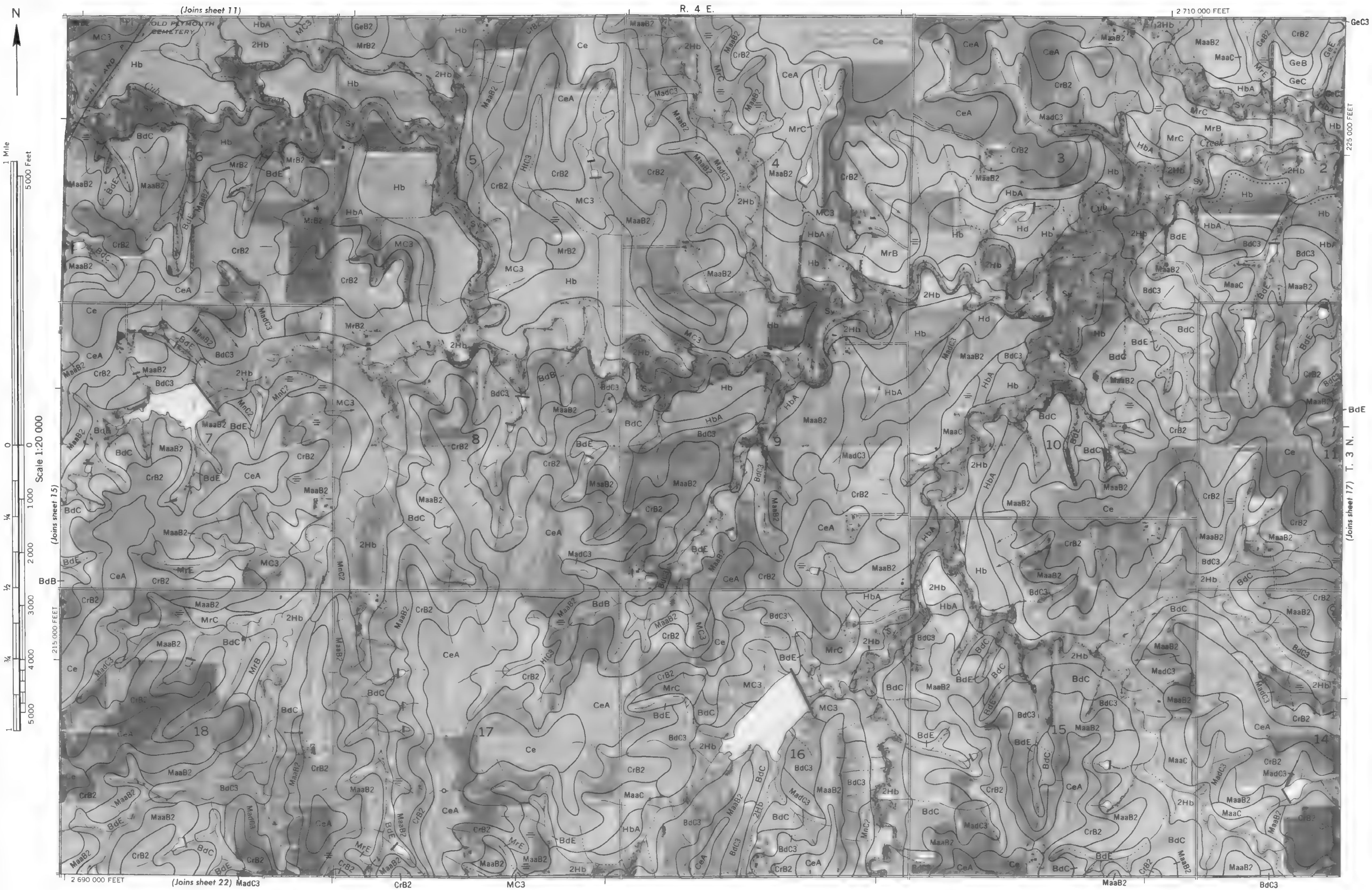
JEFFERSON COUNTY, NEBRASKA NO. 15

(16)

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 16



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17

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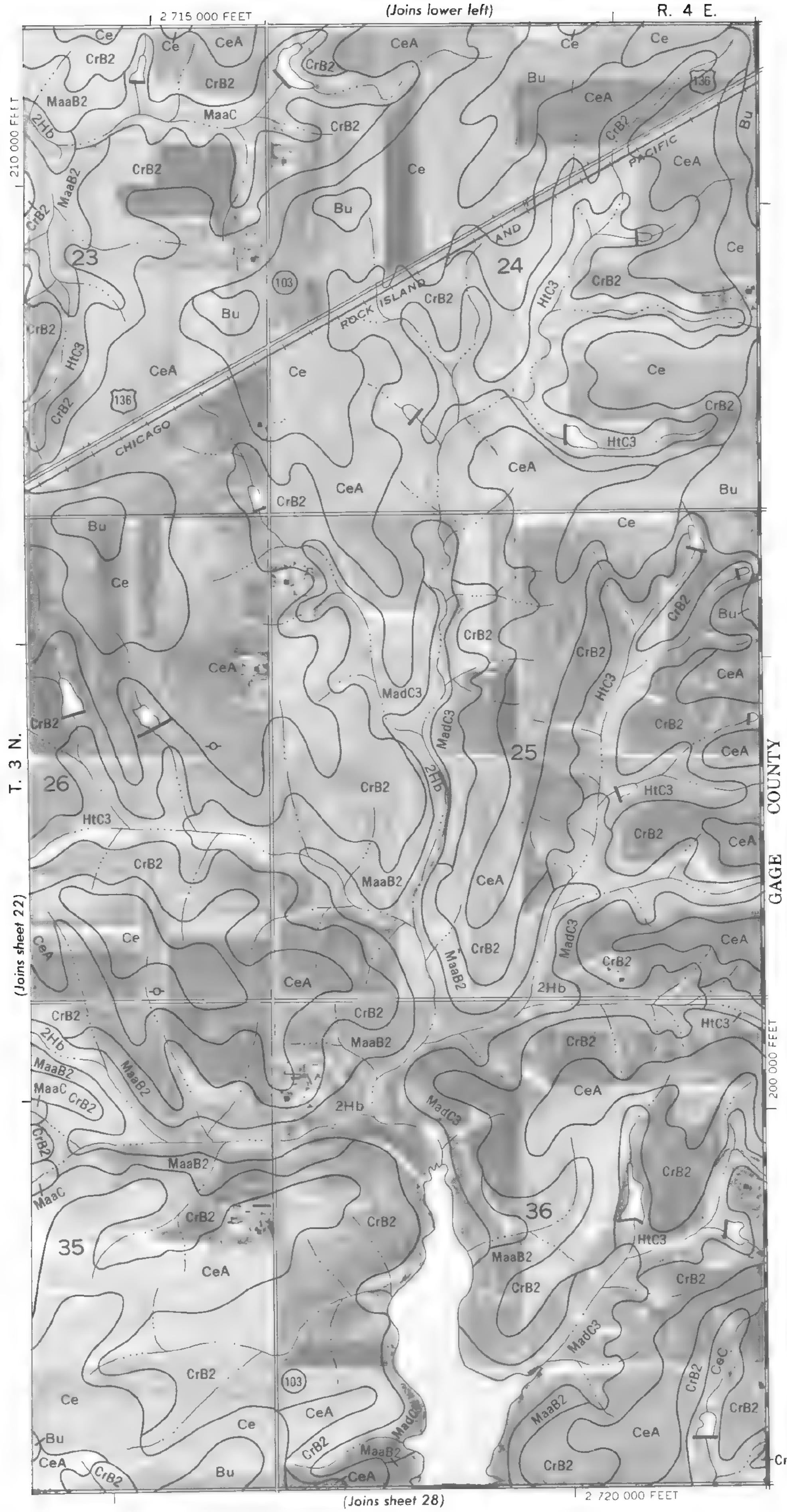
JEFFERSON COUNTY, NEBRASKA NO. 17



N

Scale 1:20 000

1 Mile | 3/4 | 1/2 | 1/4 | 0

5 000 Feet | 4 000 | 3 000 | 2 000 | 1 000 | 0

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 18

JEFFERSON COUNTY, NEBRASKA NO. 18

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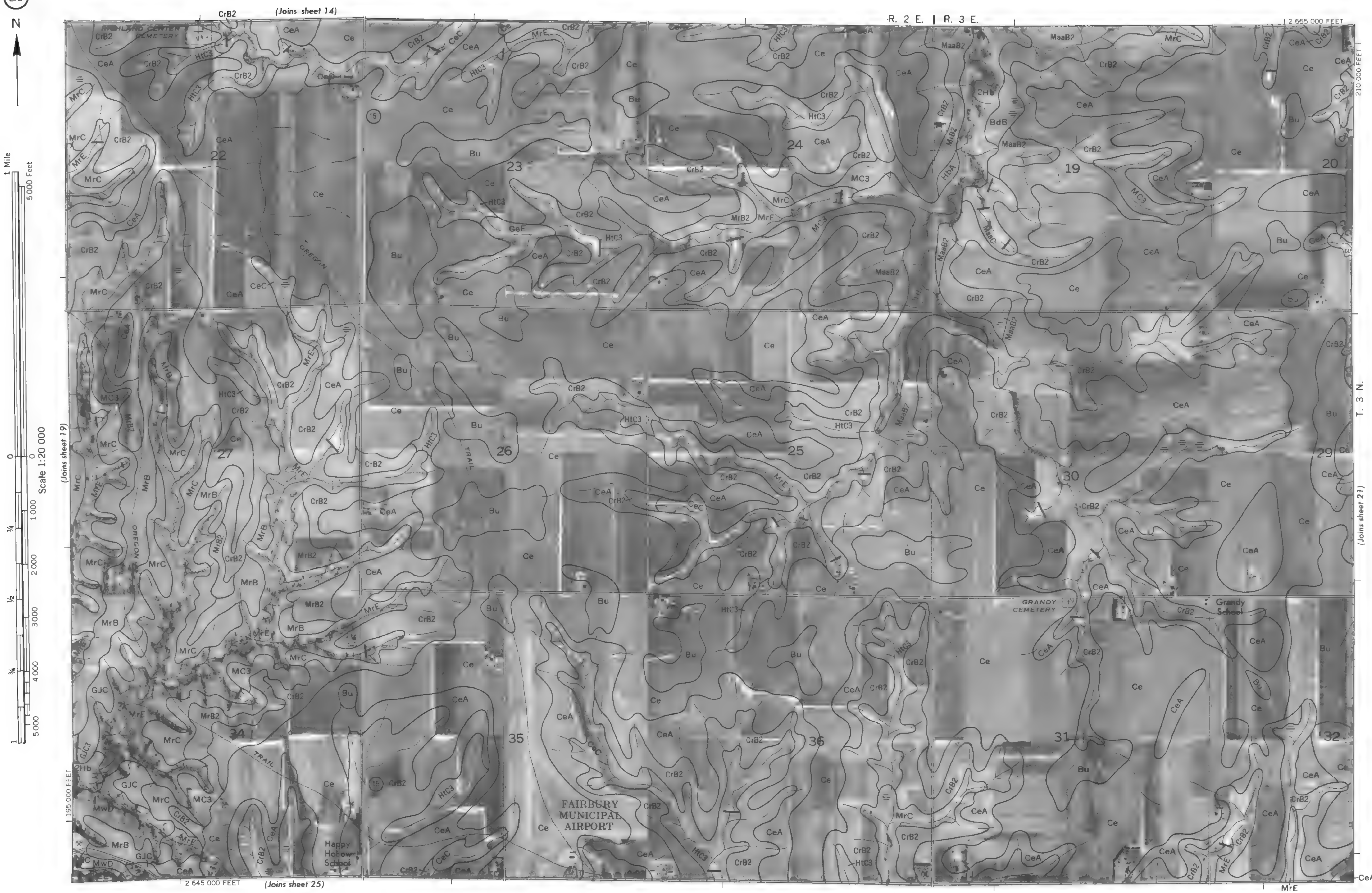
JEFFERSON COUNTY, NEBRASKA NO. 19



JEFFERSON COUNTY, NEBRASKA NO. 20

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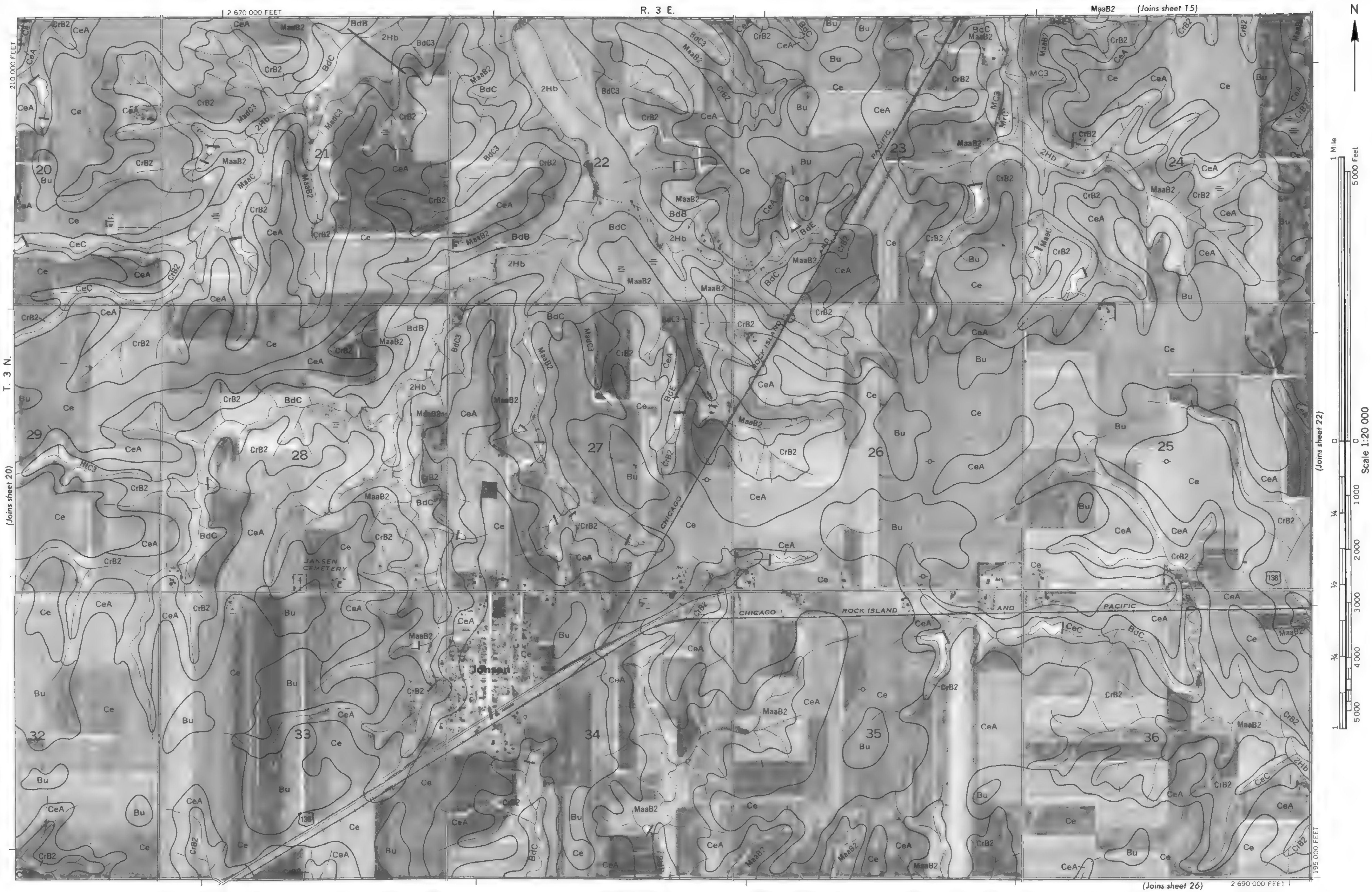

JEFFERSON COUNTY, NEBRASKA NO. 22

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25

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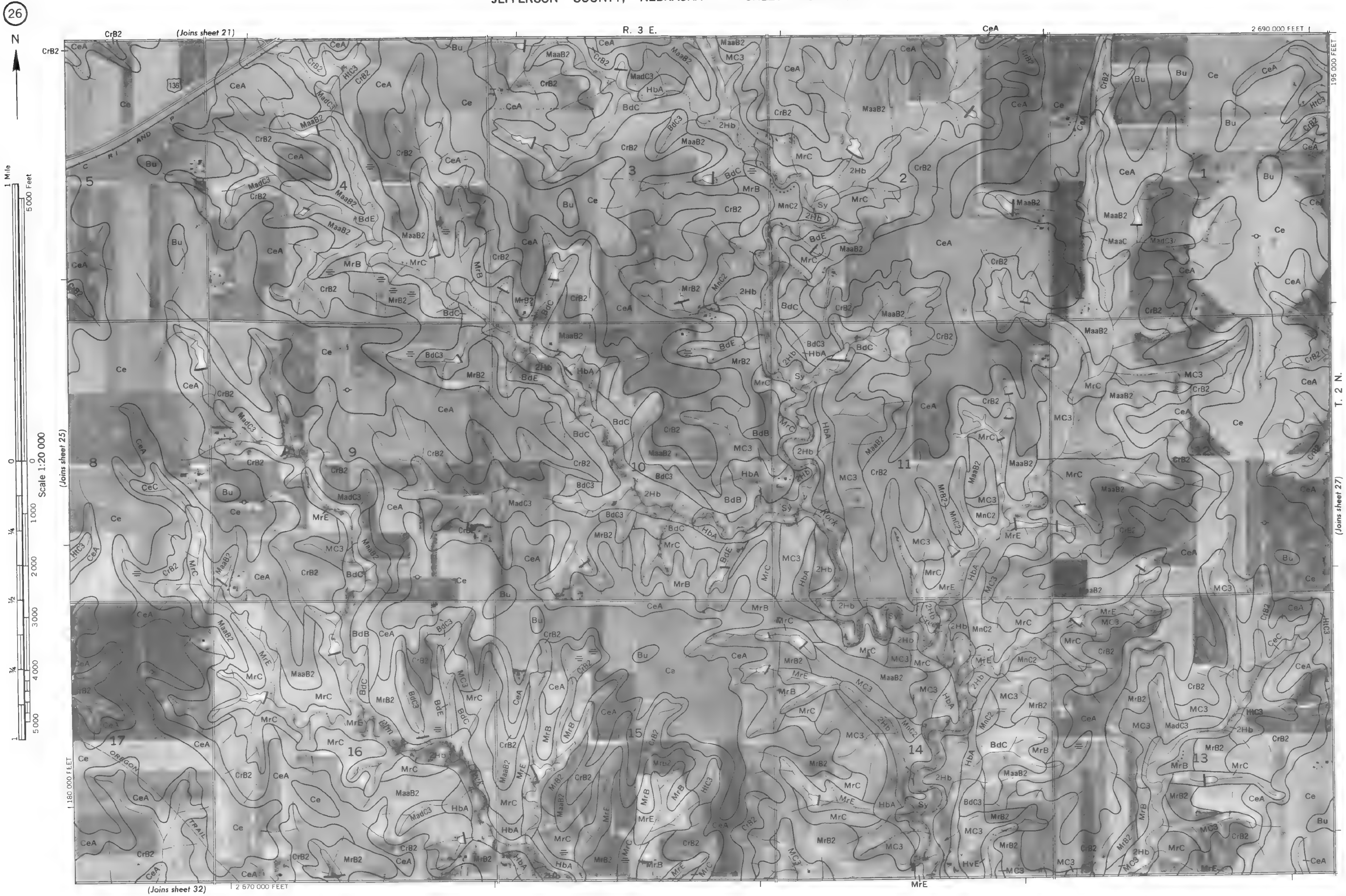
JEFFERSON COUNTY, NEBRASKA NO. 25



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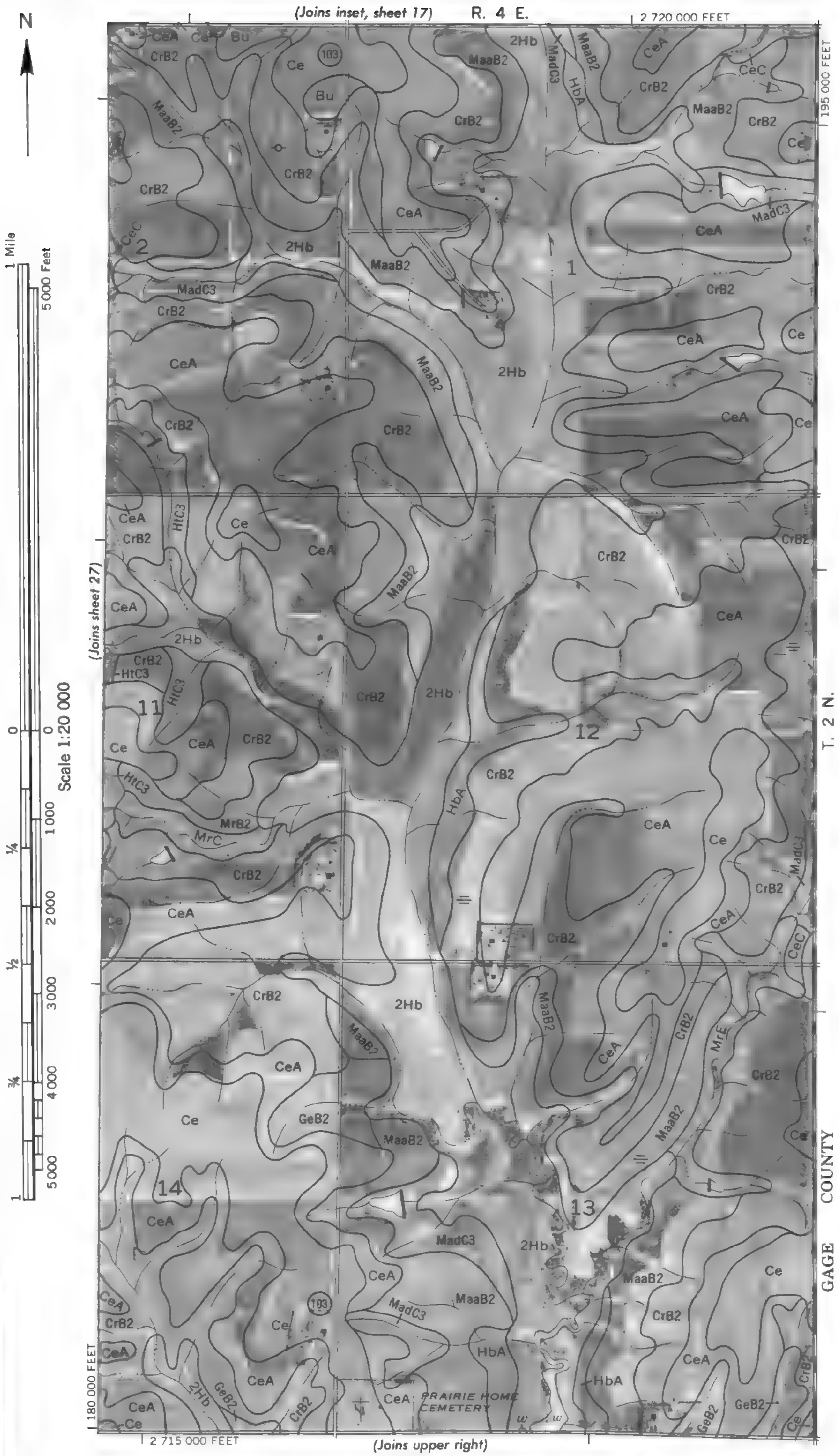
JEFFERSON COUNTY, NEBRASKA NO. 27

(28)



4,000 AND 5,000-FOOT GRID TICKS

JEFFERSON COUNTY, NEBRASKA NO. 28

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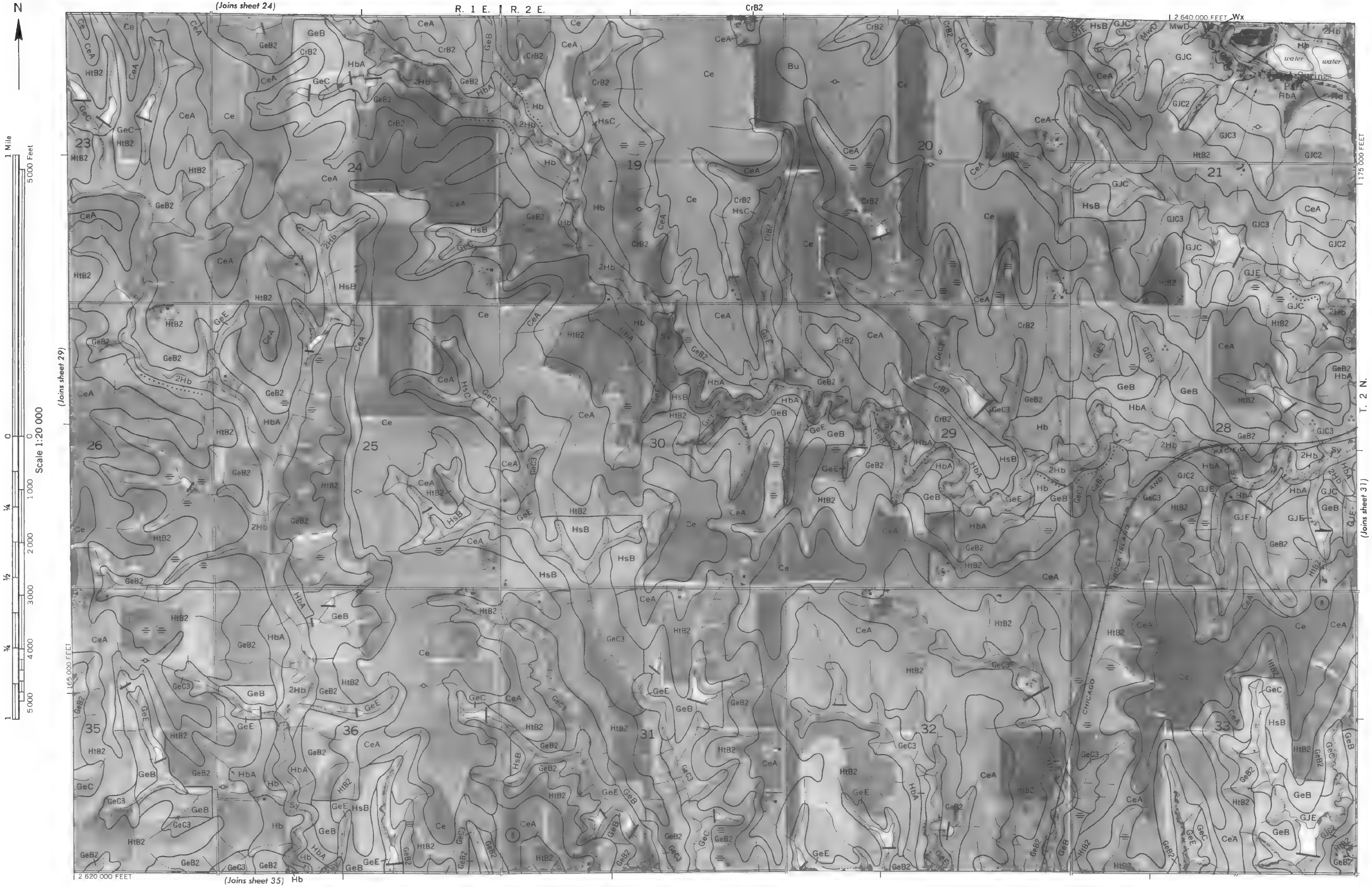
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 29

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 30



JEFFERSON COUNTY, NEBRASKA NO. 30

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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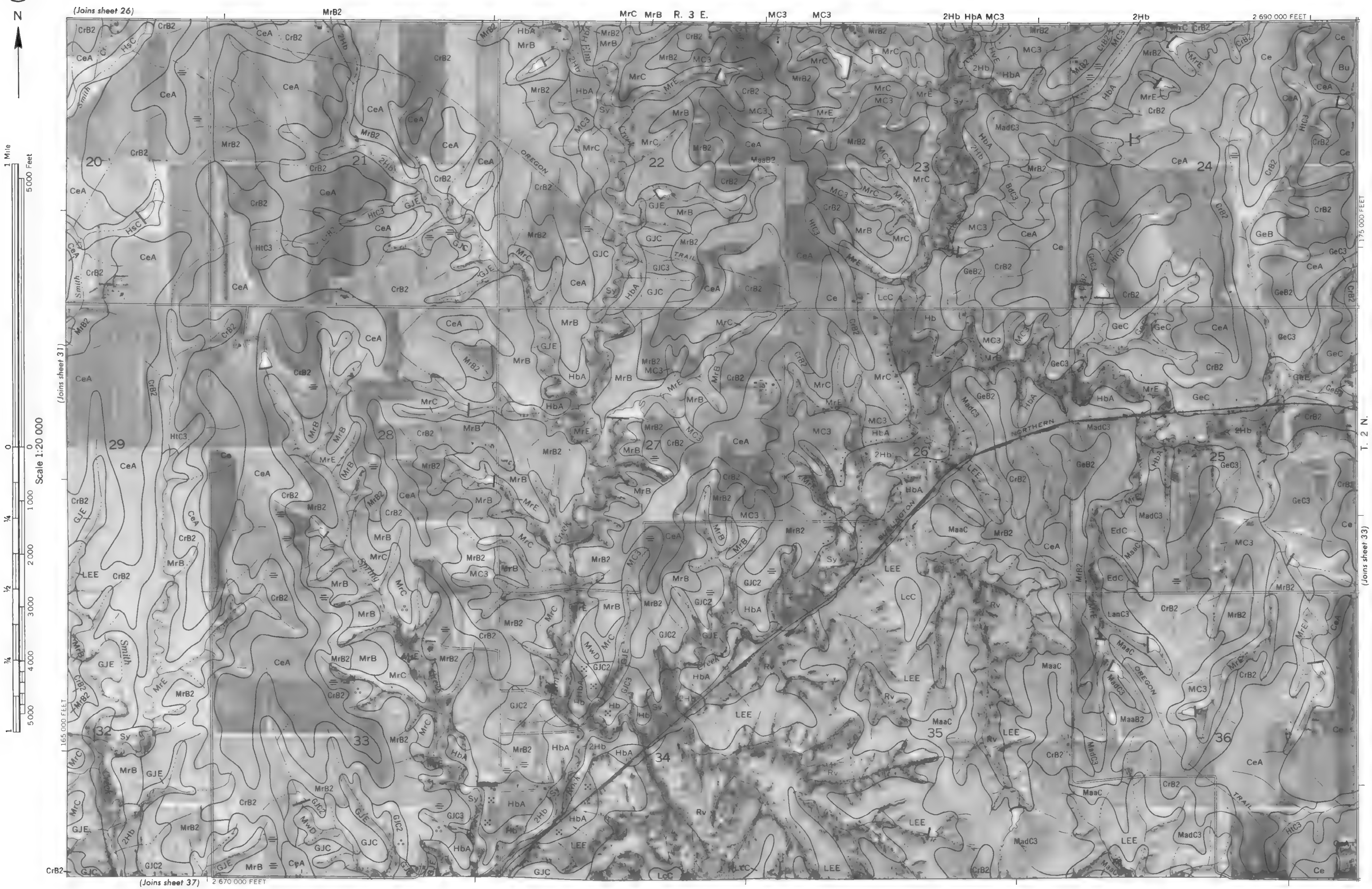
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.
Land division corners are approximately positioned on this map

JEFFERSON COUNTY, NEBRASKA NO. 31

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 32



JEFFERSON COUNTY, NEBRASKA NO. 32

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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33

JEFFERSON COUNTY, NEBRASKA NO. 33

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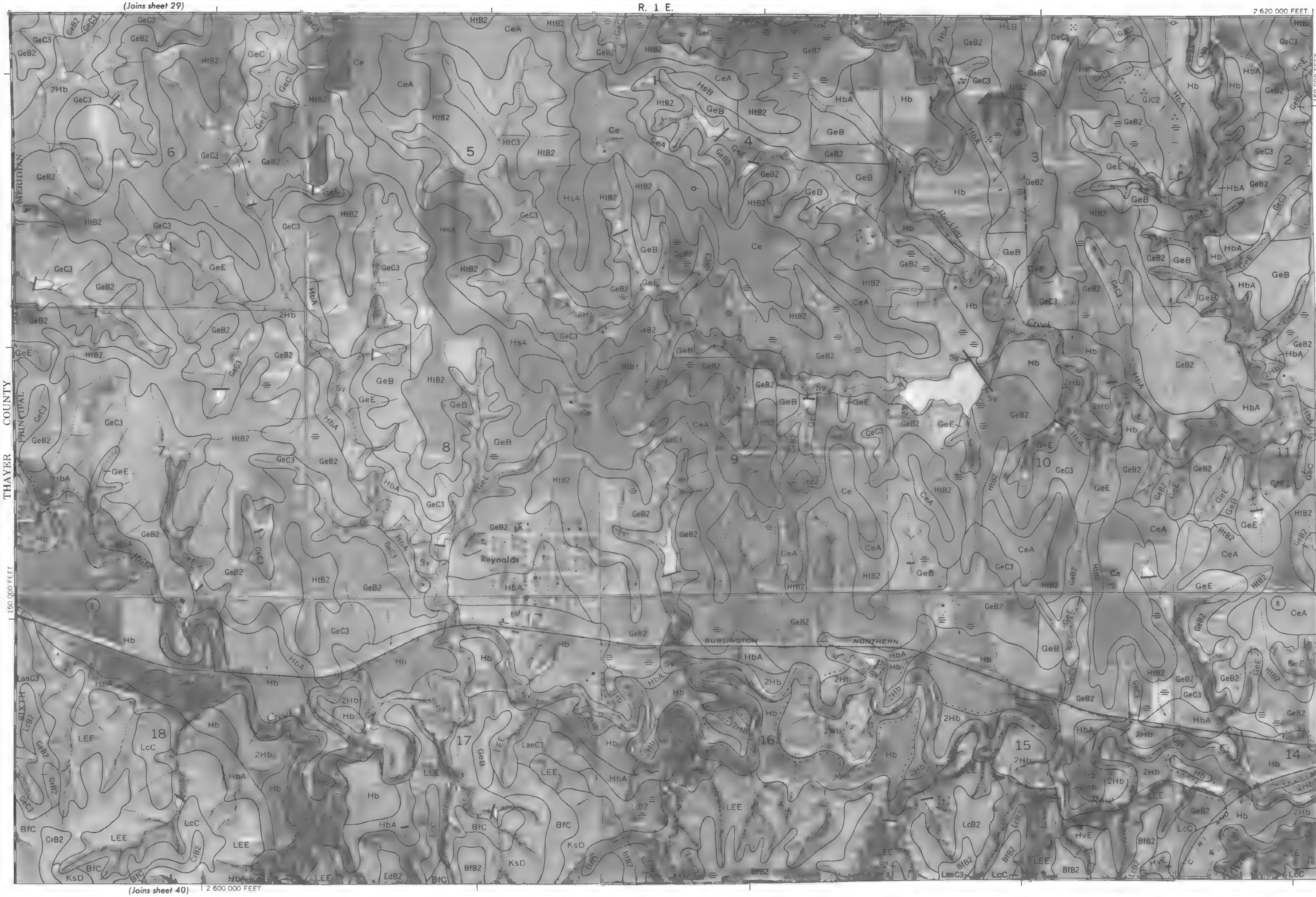
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 34

N



Scale 1:20 000
1 Mile
5000 Feet

JEFFERSON COUNTY, NEBRASKA NO. 34

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 35

(35)

N

Scale 1:20 000

1 Mile

5 000 Feet

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Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 35

36

JEFFERSON COUNTY, NEBRASKA NO. 36

Land division corners are approximately positioned on this map.

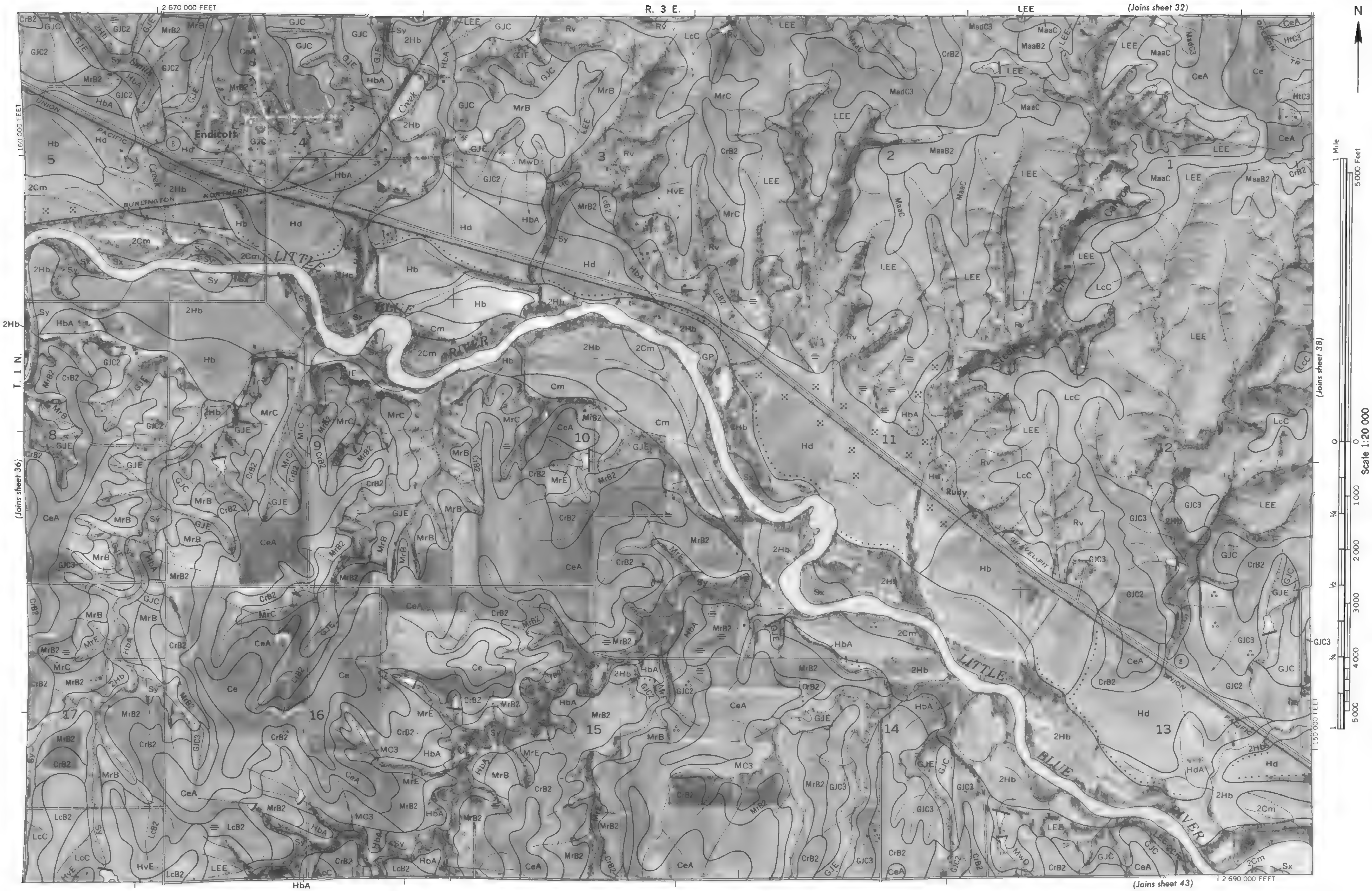
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division

(37)

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 37



JEFFERSON COUNTY, NEBRASKA NO. 38

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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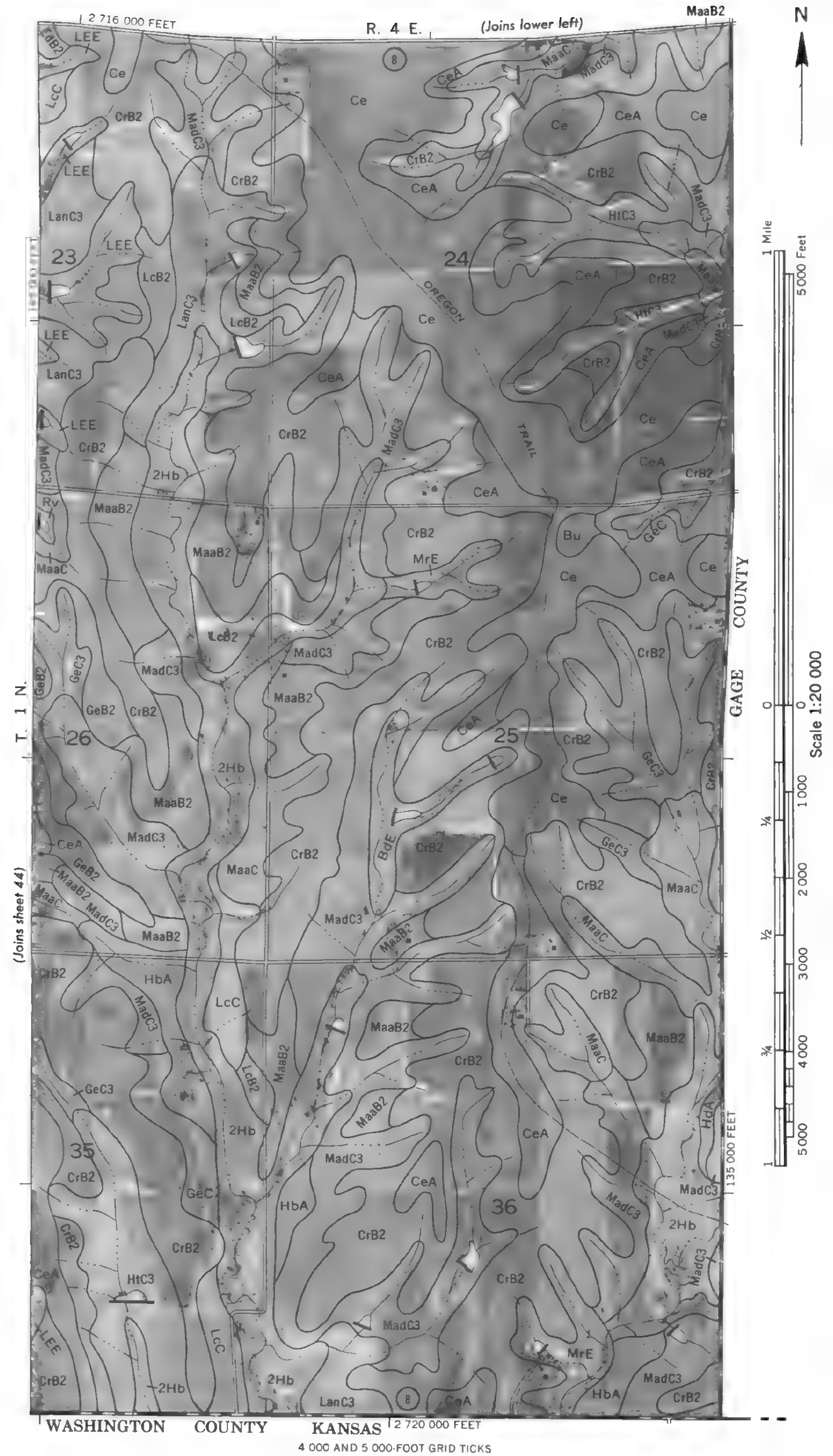
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 39



JEFFERSON COUNTY, NEBRASKA NO. 40

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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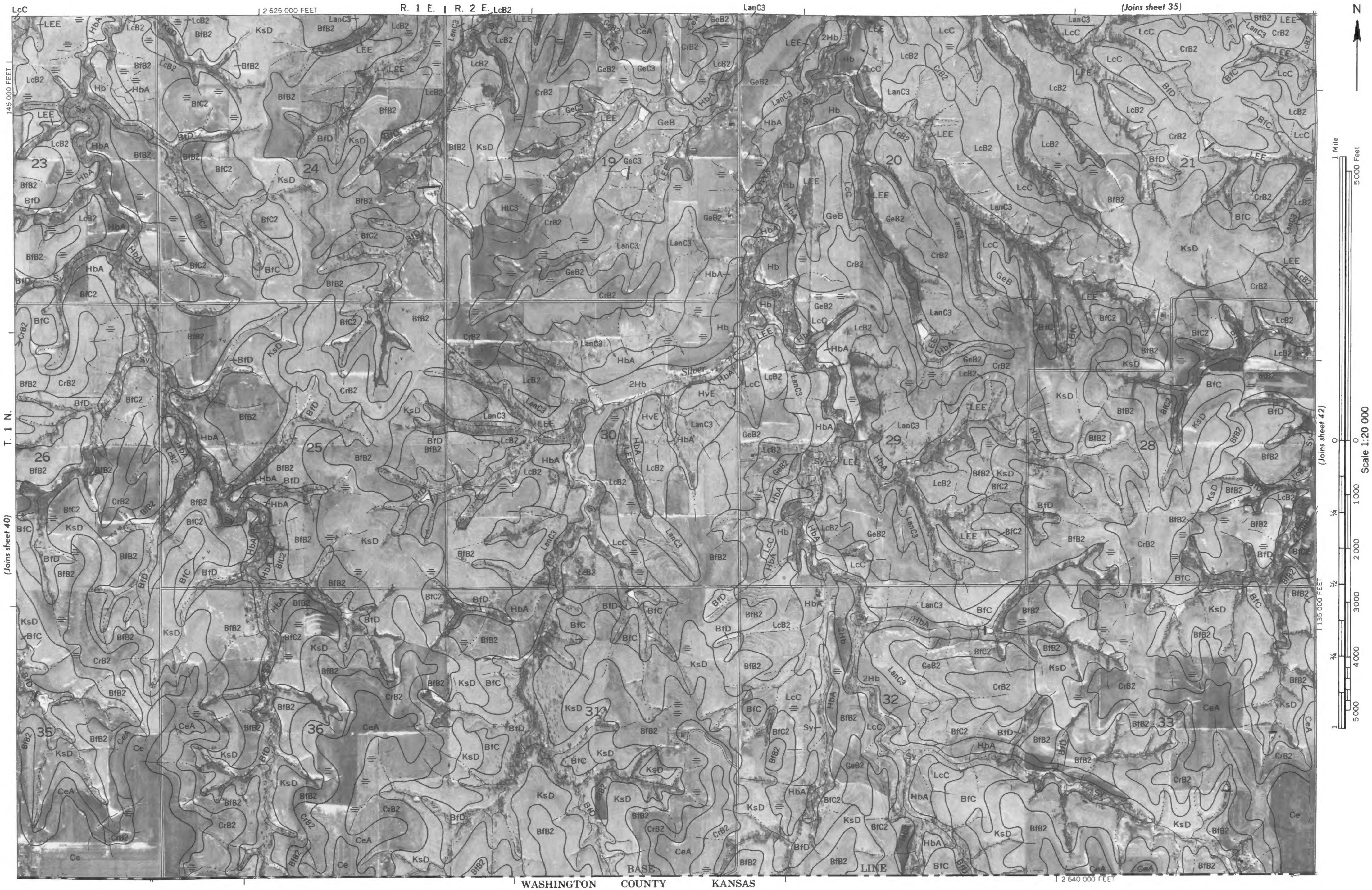
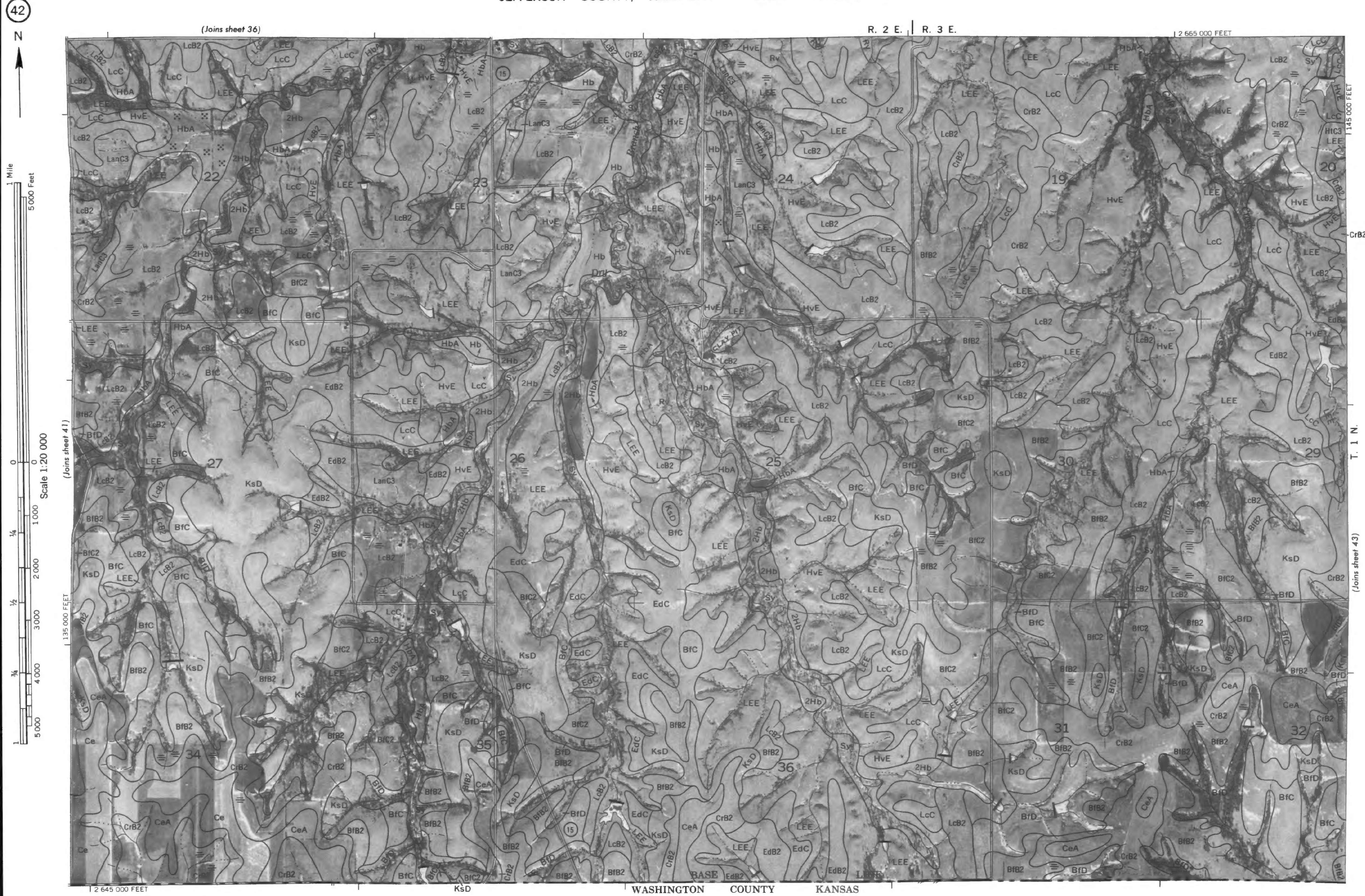
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 41





JEFFERSON COUNTY, NEBRASKA NO. 42

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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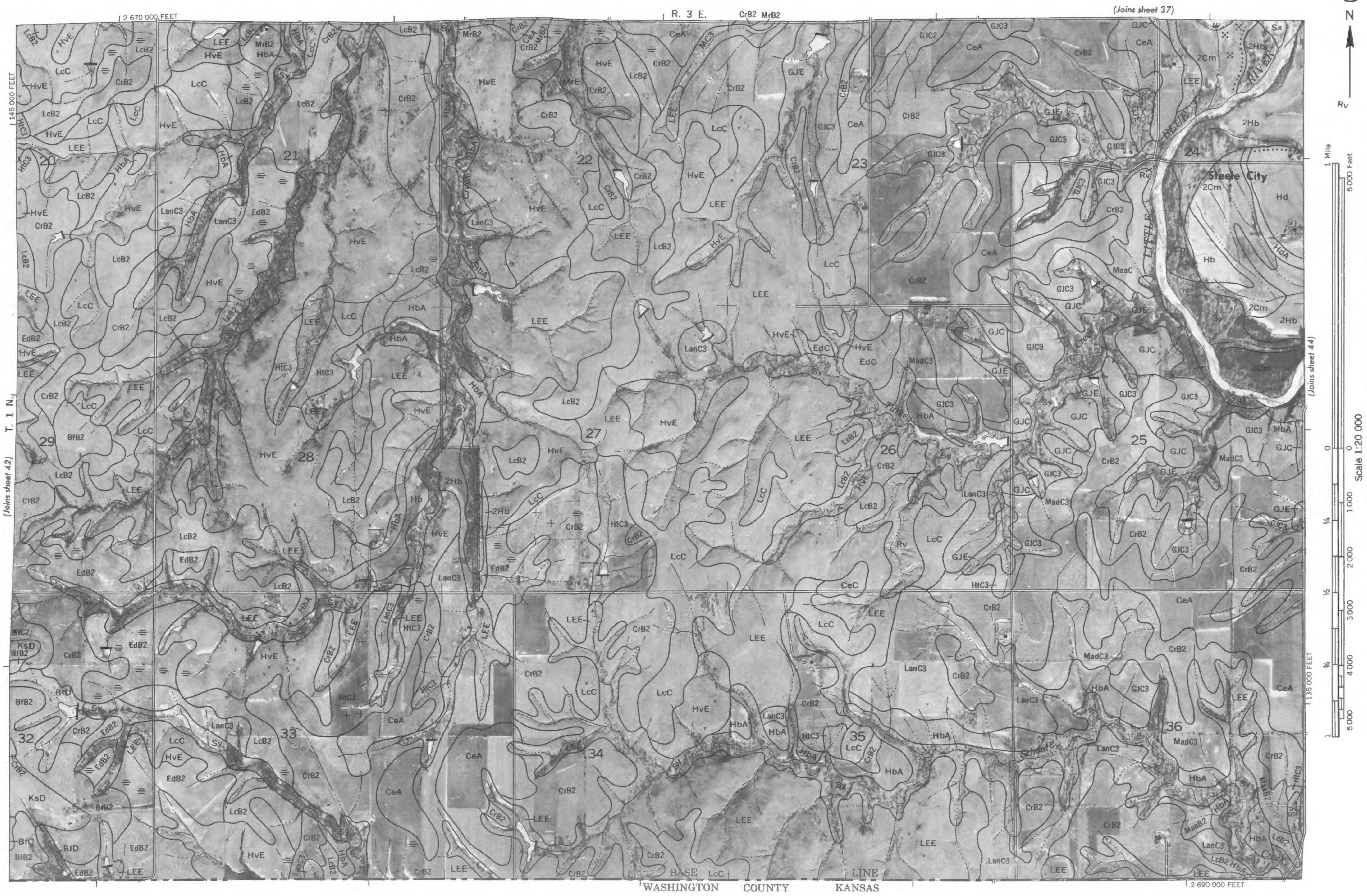
43



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Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.
Land division corners are approximately positioned on this map.

JEFFERSON COUNTY, NEBRASKA NO. 43

JEFFERSON COUNTY, NEBRASKA — SHEET NUMBER 44

N

1 Mile
5 000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

JEFFERSON COUNTY, NEBRASKA NO. 44

Land division corners are approximately positioned on this map.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, south zone.

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